



## CITY OF ABERDEEN BUILDING DEPARTMENT

BOB WAITE 537-3214

RAY OLSON 537-3250 MATT ANGLESEY 537-3221

200 EAST MARKET STREET, ABERDEEN, WA 98520-5207

(360) 537-3214 FAX (360) 537-3350

# RESIDENTIAL PLAN SUBMITTAL SUMMARY

Owner's Name \_\_\_\_\_ Permit # \_\_\_\_\_

### Office Use Only

#### 1) Site Plan

##### ■ Include:

- ☐ ■ Scaled and Dimensioned (Minimum 1/8" scale)
- ☐ a) Dimensions of the lot(s).
- ☐ b) Location and Dimensions of all existing buildings
- ☐ c) Location and Dimensions of all proposed buildings
- ☐ d) Locations of all driveways, walkways, and parking
- ☐ e) Front, rear, and sideyard dimensions
- ☐ e) All prominent land features i.e.: slopes, streams, right of ways ect.

#### 2) ELEVATION DRAWINGS

- ☐ ■ All Four Sides
- ☐ ■ Scaled (Minimum 1/8")
- ☐ ■ Include:
- ☐ a) All Exterior Door / Window / Skylight Location(s)
- ☐ b) Dryer Duct Termination Cap Location
- ☐ c) Exhaust Fan(s) (including range hood) Termination Cap Location(s)
- ☐ d) Type and Location of Exterior Wall Finish Materials(s) (including Masonry Veneers)
- ☐ e) Type and Location of All Appliance Chimneys and/or Vents
- ☐ f) Roof Pitch (x 12) / Roofing Material / Roof Overhang Depth
- ☐ g) Location(s) of Air Inlet(s)

#### 3) FLOOR PLAN

- ☐ ■ Scaled and Dimensioned (Minimum 1/4" scale) Indicating Overall and Individual Room Sizes
- ☐ ■ Each Individual Room or Space Labeled to Indicate Use
- ☐ ■ Location of IRC Prescriptive Lateral Bracing Panels or Engineered Design
- ☐ ■ Include:
- ☐ a) Location, Size (R.O.), Type and Swing of All Doors, Windows and Skylights
- ☐ b) Size and Type of All Load-Bearing Beams\* / Headers\*
- ☐ c) Delineate Area with Vaulted Ceilings
- ☐ d) Location and Fuel Type of Furnace, Fireplace or Free-Standing Stove

- ☐ e) Location, Size (gallons) and Fuel Type of Hot Water Tank
- ☐ f) Location and Type of All Plumbing Fixtures
- ☐ g) Location and Size of All Exhaust Fans (including Range Hood)
- ☐ h) Location of All Attic Access(s)
- ☐ i) Location of All Smoke Alarms
- ☐ j) Location of All Required Illumination and Controls at Stairways
- ☐ k) Size, Type and Location(s) of all Exterior Decks and Landings

**\*Include Engineering Calculations for Non-Dimensional Lumber Members**

#### **4) FOUNDATION PLAN**

- ☐ ■ Scaled and Dimensioned (Minimum 1/4" scale)
- ☐ ■ Location and Dimension of All Footings, Walls, Piers and Slabs (including Decks)
- ☐ ■ Include:
  - ☐ a) Section Drawings for Each Type of Footing / Wall (see **SECTION DRAWINGS**)
  - ☐ b) Size, Grade, Location and Spacing of Reinforcing (see **SECTION DRAWINGS**)
  - ☐ c) Size, Type and Spacing of Anchor Bolts
  - ☐ d) Type and Location(s) of Required Holdowns
  - ☐ e) Size and Locations of Foundation Vents and Access(s)
  - ☐ f) Annotation for Required Perimeter or Under-Slab Insulation
  - ☐ g) Annotation for Required Moisture Barrier (or Alternative)

#### **5) FLOOR JOISTING PLAN (Each Floor Level and Exterior Decks)**

- ☐ ■ Scaled and Dimensioned (Minimum 1/8" Scale)
- ☐ ■ Size, Location and Type of Support Beams and Posts / Interior Bearing Walls
- ☐ ■ Size, Direction, O.C. Spacing and Type of Floor Joists
- ☐ ■ Include:
  - ☐ a) Specification and Installation Guide for All Engineered Joists
  - ☐ b) Construction Details at Openings / Cantilevers / Offsets
  - ☐ c) Type of Rim Joist Material
  - ☐ d) Any Special Connection / Construction / Fabrication Details or Requirements
  - ☐ e) Deck Ledger Attachment

**Note:** Floor Joisting Plan(s) may be incorporated with the **FOUNDATION** or **FLOOR PLAN** when clarity of detail can be maintained.

#### **6) ROOF FRAMING PLAN**

- ☐ ■ Scaled and Dimensioned (Minimum 1/8" Scale)
- ☐ ■ Location and O.C. Spacing of Manufactured Trusses, Rafters and Ceiling Joists
- ☐ ■ Include:
  - ☐ a) Manufacturer's Layout and Specifications for All Trusses
  - ☐ b) Size, Species and Grade of Dimensional Lumber
  - ☐ c) Specification and Installation Guide for All Engineered Rafters /

- ☐ Ceiling Joists
- ☐ d) Size, Type and Location of All Roof Support Beams and Bearing Walls
- ☐ e) Type, Size and Location of Roof Vent(s)

## 7) SECTION DRAWINGS

- ☐ ■ Scaled and Dimensioned (Minimum 1/4" scale)
- ☐ ■ For Each Wall and/or Ceiling Height
- ☐ ■ Include:
  - ☐ a) Identify All Floor, Wall, Ceiling and Roof Materials and Finishes
  - ☐ b) Annotate All Framing Member Type and Size
  - ☐ c) Annotate Height of Crawlspace, and Each Floor and Ceiling Height
  - ☐ d) Annotate All Structural Connections and Fasteners
  - ☐ e) Annotate All Insulation Types, R-Values and Locations
  - ☐ f) Annotate All Vapor Barrier Types and Locations
  - ☐ g) Annotate Location and Type of Flashings at Wall and Roof Penetrations
  - ☐ h) Annotate Type and Location of Underlayments and Water-Resistive Barriers

## 8) WASHINGTON STATE ENERGY AND VENTILATION CODE

- ☐ ■ Complete the PRESCRIPTIVE or COMPONENT PERFORMANCE Worksheets([http://www.energy.wsu.edu/documents/code/wsec2006/Prescriptive\\_Zone1\\_R1\\_2006.xls](http://www.energy.wsu.edu/documents/code/wsec2006/Prescriptive_Zone1_R1_2006.xls)) or:
- ☐ ■ Provide Heating System Compliance Summary per ACCA Manual J
- ☐ ■ Complete Ventilation Compliance Worksheet

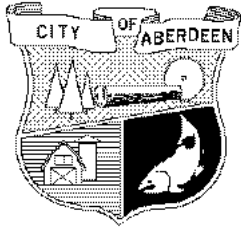
## 9) FLOOR ELEVATIONS

- ☐ ■ All Commercial Structures and Residential Dwelling Units within the Flood Zone are required to have the floor elevation set by a licensed surveyor and a Flood Elevation Certificate provided PRIOR to the issuance of the Certificate of Occupancy
- ☐ ■ Minimum Fill and Floor Elevations of all other structures south of the Chehalis River shall be set by the City of Aberdeen Engineering Dept.

## 10) STORM DRAINAGE PLAN

- ☐ a) Dimensions of the lot(s).
- ☐ b) Location and Dimensions of all existing buildings
- ☐ c) Location and Dimensions of all proposed buildings
- ☐ d) Locations of all driveways, walkways, and parking
- ☐ e) Location and Direction of flow of all proposed drain lines
- ☐ f) All prominent land features i.e.: slopes, streams, right of ways ect.





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Inspection Request Line (360) 537-3214

# RESIDENTIAL PLAN REVIEW CHECKLIST

Owner: \_\_\_\_\_ Contractor: \_\_\_\_\_

Permit Number: \_\_\_\_\_ Site Address: \_\_\_\_\_

Plans Examiner: \_\_\_\_\_ Date: \_\_\_\_\_

- 2006 International Residential Code (IRC) WAC51-51
- 2006 International Building Code (IBC) WAC51-50
- 2006 International Mechanical Code (IMC) WAC 51-52
- 2006 Uniform Plumbing Code (UPC) WAC 51-56 & 51-57
- 2006 Washington State Energy Code (WSEC), WAC 51-11
- 2006 Washington State Ventilation and Indoor Air Quality Code (WSVIAQ), WAC 51-13
- Seismic Zone D-2, Wind load 105 mph 3 sec. gust, exposure B,
- Roof snow load 25lbs. Per square foot. Floor live load varies, see R301.5.

The numbered items on the following pages are associated with the above referenced codes, as adopted by The City of Aberdeen.. This checklist is submitted as information only, and shall not be construed as an all-inclusive list of code requirements. Errors or omissions in the plans and specifications shall not prevent the Building Official, or his authorized agents, from requiring revisions or corrections to these plans, and stopping the progress of the project under permit.

Office hours are from 8:00a.m. until 5:00 p.m. Monday through Friday.

Inspections can be scheduled by calling (360) 537-3214.

To schedule an inspection the following information will be needed: Permit number, site address, name of owner, type inspection requested, and the telephone number The City of Aberdeen staff should use when they call to confirm the inspection.

# FLOOR PLAN

1. **CONSTRUCTION DOCUMENTS & COMPLIANCE TO APPROVED PLANS :** IRC Section R106.

Approved site plans shall be attached to the approved building plans during inspection. Property lines shall be marked. Setback distances will be measured from the furthest projection of the permitted structure. Manufacturer's installation instructions shall be available on the job site at the time of inspection. All work shall be installed in accordance with the approved construction documents. Any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

2. **EGRESS WINDOWS:** IRC Section R310. All sleeping rooms and basements with habitable space shall have at least one openable emergency escape and rescue opening. Such opening shall open directly into a public street, public alley, yard or court. Emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet. Except that grade floor openings shall have a minimum net clear opening of 5 square feet (*see definition below*). The minimum net clear opening height dimension shall be 24". The minimum net clear opening width dimension shall be 20". The openings shall have a finished sill height not more than 44" above the floor. Emergency escape and rescue openings shall be operational from the inside of the room without use of keys or tools or special knowledge. Window wells shall be provided when egress windows have a finished sill height below adjacent ground elevation. The well shall allow the window to be fully opened and provide a minimum horizontal area of 9 sq. ft., with a minimum horizontal projection and width of 36-inches. Window wells with a vertical depth of more than 44" shall be equipped with a permanent ladder. *Grade floor opening definition: A window or other opening located such that the sill height of the opening is not more than 44" above or below the finished ground level adjacent to the opening.*

3. **SMOKE ALARMS:** IRC Section R313. All smoke alarms shall be listed in accordance with UL217 and installed in accordance with the provisions of the International Residential Code and the household warning equipment provisions of NFPA 72. Smoke alarms shall be installed in each sleeping room, outside each separate sleeping area in the immediate vicinity of the bedrooms, and on each additional story of the dwelling, including basements. Each floor and basement shall have at least one detector. When more than one smoke alarm is required to be installed the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed. Required smoke alarms shall receive their primary power

from the building wiring when such wiring is served from a commercial source and when primary power is interrupted, shall receive power from a battery. Additions, interior alterations, and repairs shall be provided with smoke alarms as required for new dwellings; the smoke alarms shall be interconnected and hard wired. (*Exception: Smoke alarms are not required to be interconnected and hardwired where the alteration or repairs does not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space, or basement available which could provide access for hard wiring and interconnection without removal of hard finishes. Repairs to the exterior surfaces of dwellings are exempt from these requirements*).

4. **SAFETY GLAZING:** IRC Section R308. All glass located in areas that are considered hazardous must be safety glazed and provided with a manufacturer's designation, designating the type of glass and the safety glazing standard with which it complies, which is visible in the final installation. The designation shall be acid etched, sandblasted, ceramic-fired, laser etched, embossed, or be of a type which once applied cannot be removed without being destroyed. A label may be permitted in lieu of the manufacturer's designation. The following shall be considered hazardous locations:
1. Glazing in swinging doors.
  2. Glazing in fixed and sliding door assemblies and panels in sliding and bifold closet doors.
  3. Glazing in storm doors.
  4. Glazing in all unframed swinging doors.
  5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and shower. Glazing in any part of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60-inches measured vertically above any standing or walking surface.
  6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24-inch arc of the door in a closed position and whose bottom edge is less than 60" above the floor or walking surface.
  7. Glazing that meets all of the following conditions:
    - 7.1. Exposed area of an individual pane is greater than 9 square feet.
    - 7.2. Exposed bottom edge is less than 18" above the floor.
    - 7.3. Top edge greater than 36" above the floor.
    - 7.4. One or more walking surfaces within 36" horizontally of the plane of the glazing.
  8. All glazing in railings
  9. Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs and spas where the bottom edge of the glazing is less than

60 inches above a walking surface and within 60" of the water's edge.

10. Glazing adjacent to stairways, landings and ramps within 36" horizontally of a walking surface when the exposed surface of the glass is less than 60" above the plane of the adjacent walking surface.
11. Glazing adjacent to stairways within 60" horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60" above the nose of the tread.  
*Exception #9:* Referencing items #10 & 11 above, safety glazing is not required where:  
9.1) the side of a stairway, landing or ramp has a guardrail or handrail, including balusters or in-fill panels, complying with the provisions of IBC Sections 1013 and 1607.7.  
9.2) The plane of the glass is more than 18-inches from the railing, or  
9.3) When a solid wall or panel extends from the plane of the adjacent walking surface to 34 inches to 36 inches above the floor and the construction at the top of that wall or panel is capable of withstanding the same horizontal load as the protective bar.

*See also code for exceptions for Items 1 through 11.*

5. **NATURAL LIGHT & VENTILATION:** IRC Section R303. All habitable rooms shall be provided aggregate-glazing area of not less than 8% of the area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. The minimum openable area to the outdoors shall be 4% of the floor area being ventilated. *Exception: 1) The glazed area need not be openable where the opening is not required by R310 (egress) and an approved mechanical ventilation system is provided capable of producing .35 ACH in the room or a Whole house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cfm per occupant computed on the basis of two occupants for the 1<sup>st</sup> bedroom and one occupant for each additional bedroom. 2) The glazed areas need not be provided in rooms where exception 1 is satisfied and artificial light is capable of producing an average illumination of 6 foot-candles over the area of the room at a height of 30 inches above the floor level.*
6. **EXHAUST FANS:** WSVIAQ Section 302.2.1, IRC R303.4, Section M1501, M1507, IMC Section 501.2. Exhaust fans are required in each kitchen, bathroom, water closet room, laundry facility, indoor swimming pool, spa and other rooms where excess water vapor or cooking odor is produced. The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a nuisance and not less than the distances specified in IMC Section 501.2.1. The air shall be discharged to a location from which it cannot again be readily drawn in by a ventilating system. Dryer exhaust ducts shall not be exhausted into an attic or crawl space. The termination point shall be located at least 3-

feet from property lines, 3-feet from operable openings into the building other than Group U occupancies, and 10-feet from mechanical air intakes. See energy section of this checklist for more specific requirements.

7. **CLOTHES DRYERS:** IRC Section M1502, G2439, & IMC Section 504. Exhaust ducts shall be constructed of .016-inch-thick rigid metal ducts, having smooth interior surfaces with joints running in the direction of air flow. Exhaust ducts shall not be connected with sheet-metal screws or fastening means which extends into the duct. Transition ducts shall not be concealed within construction. Flexible transition ducts used to connect the dryer to the exhaust system shall be limited to single lengths, not to exceed 8-feet and shall be listed and labeled in accordance to UL 2158A. Exhaust ducts shall terminate outside the building not less than 3-feet in any direction from openings into buildings. Screens shall not be installed at the duct termination. Ducts shall be equipped with a backdraft damper. The minimum duct diameter shall be 4" and shall be supported and secured in place. The maximum length of a clothes dryer exhaust duct shall not exceed 25 feet from the dryer location to the wall or roof termination. The maximum length of the duct shall be reduced 2.5 feet for each 45-degree bend and 5 feet for each 90-degree bend. The maximum length of the exhaust duct does not include the transition duct.  
*Exception: Ducts installed in accordance with the dryer manufacturer's installation instructions.*
8. **RANGE HOOD:** IRC Section M1501, M1503, M1504, M1901, WSVIAQ Section 302.1 & Table 3-1. Overhead exhaust hoods, capable of exhausting 100 cfm at .10 inches water gauge, shall discharge to the outdoors through a single wall metal exhaust hood (galvanized steel, stainless steel, or copper). Such ducts shall have a smooth inner wall and be air tight and equipped with a backdraft damper. Clearance of at least 24" shall be maintained between the cooking surface and the combustible material or cabinet. Reduced clearances are permitted in accordance with the listing and labeling of the range hoods or appliances. Clearances to combustibles shall include such considerations as door swing, drawer pull, overhead projections or shelving and window swing, coverings and drapes. **Refer to WSVIAQ Section 302.1 & Table 3-1 for more specific requirements.**
9. **WATER CLOSET:** IRC Section R307, UPC Section 408, 402. Water closet shall be located in a clear space not less than 30" in width. The clear space in front shall not be less than 21". Water closet seats shall be of smooth, non-absorbent material. The maximum water use allowed in gallons per flush (gpf) shall not exceed 1.6.
10. **SHOWER AREAS:** IRC Section R307, and UPC Sections 411, 414, 415, and 418. Bathtub and shower floors and walls above bathtubs with installed showerheads and in shower compartments shall be finished with non-absorbent surfaces that extend to a

height of not less than 6-feet above the floor. The clear space in front of the shower opening shall not be less than 24". All showers shall have a minimum finished interior floor area of 1024 square inches and shall be capable of encompassing a 30-inch circle. The minimum area and dimensions shall be maintained to a point 70" above the shower drain outlet. Shower receptors shall have curbs not less than 2-inches and not more than 9-inches deep. The finished floor shall slope uniformly toward the drain not less than 1/4-inch vertical per foot horizontal (2% slope) nor more than 1/2" per foot, and floor drains shall be flanged to provide water-tight joint in the floor. On-site built-up shower receptors shall be lined in accordance to UPC Section 411.8. Shower receptors shall be tested for water tightness by filling with water to the level of the rough threshold. A removable panel shall be provided to access and remove whirlpool pumps. Whirlpool pump access located in the crawl space shall be located no more than 20-feet from an access door. Showers and tub-shower combinations shall be provided with individual control valves that provide scald and thermal shock protection and shall conform with ASSE 1016. Hot water supplied to bathtubs, whirlpool bathtubs and showers shall be limited to a maximum temperature of 120°F. The water heater thermostat shall not be considered a suitable control for meeting this provision.

11. **CHIMNEYS & FIREPLACES:** IRC Chapter 10. R905. Factory-built chimneys and fireplaces shall be labeled and installed in accordance with the conditions of the listing. Factory built chimneys installed in dwelling units with solid-fuel-burning appliances shall comply with the HT requirements of UL 103 and shall be marked "Type HT and Residential Type and Building Heating Appliance Chimney." Masonry chimneys: Masonry and concrete chimneys shall be anchored at each floor, ceiling or roofline more than 6 feet above grade except where constructed completely within exterior walls. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more than 30-inches wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering. Crickets shall be constructed in compliance with Figure R1003.20 and Table R1003.20. See also seismic anchorage requirements in IRC Section R1001.4.
12. **TIGHT-FITTING DOORS (FIREPLACE):** WSVIAQ Section 402. Solid fuel burning appliances and fireplaces shall be provided with tight-fitting glass or metal doors. An outside source for combustion air shall be ducted to the firebox.
- 13.
13. **FIREPLACE HEARTH EXTENSION:** IRC Sections R1001.9, R1001.10 and R1004.2, M1414.2. Hearth extensions of approved factory-built fireplaces shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials.

Fireplace hearths shall be at least 4" thick and hearth extensions shall be at least 2" thick. The fireplace extension shall extend at least 16" in front of, and at least 8" beyond each side of the fireplace opening. Where the fireplace opening is 6 square feet or larger, the hearth extension shall extend at least 20" in front of, and at least 12" beyond each side of the fireplace opening.

14. **CLEARANCE TO COMBUSTIBLES & FIREPLACE FIREBLOCKING:** IRC Sections R808, R1001, 1003.18, 1003.19, R602.8, and M1306. Combustible insulation shall be separated a minimum of 3" from heat producing appliances. *Exception: Insulation shall be separated in accordance with conditions stipulated in manufacturer's listing.* When masonry chimneys are built within a structure, minimum 2" air space clearance to combustible material is required. When the chimney is placed on the exterior of the structure, a 1" clearance is allowed. The air space shall not be filled, except to provide noncombustible fire blocking. All wood beams, joists, studs and other combustible material shall have a clearance of not less than 2" from the front faces and sides of masonry fireplaces and not less than 4" from the back faces of masonry fireplaces. The air space shall not be filled, except to provide fireblocking in accordance to Section R602.8 (see item #64). All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between chimneys and wood beams, joists, or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.. The air space shall not be filled, except to provide fire blocking in accordance with sections R1003.19. Woodwork or other combustible materials shall not be placed within 6" of a fireplace opening. Combustible material placed within 12" of the fireplace opening (such as mantles or decorative fireplace surrounds) shall not project more than 1/8" for each 1" clearance from the opening.
15. **COMBUSTION AIR/EXTERIOR AIR SUPPLY:** WSVIAQ Section 402, IRC R303.4, R1006, Chapter M17, M1602, IMC Chapter 7. Fuel burning appliances shall be provided with combustion air obtained from outside the structure. Direct vent appliances or equipment that does not draw combustion air from inside of the building are not required to be considered in the determination of the combustion and dilution air requirements. Fuel gas dryers shall be provided with make-up air as directed by manufacturer specifications. Fuel burning equipment located within the conditioned space that require combustion air shall be provided with outside combustion air through openings or ducts as illustrated in figures M1703.2(1), M1703.2(2), M1703.2(3), and 1703.2(4). One opening shall be within 12-inches of the top of the enclosure, and one within 12-inches of the bottom of the enclosure. Vertical ducts shall provide free area of at least 1-square inch per 4,000



Btu/hour of total input rating of all appliances in the space. Where horizontal ducts are used, each opening shall have a free area of at least one-square inch per 2,000 Btu/hr of total input of all appliances in the space. The minimum rectangular air ducts shall be 3-inches. Outside combustion air openings shall be corrosion resistant screen or equivalent protection having not less than ¼-inch openings and not greater than ½-inch openings. Unless otherwise specified by the manufacturer or determined by actual measurement, the free area shall be considered 75% of the gross area for metal louvers and 25% of the gross area for wood louvers. Volume dampers (manual dampers) shall not be installed in combustion air openings. Openings shall be covered with corrosion-resistant screen, not less than ¼-inch openings and not greater than ½-inch openings. Outdoor air openings for fuel-burning appliances are permitted to connect spaces such as ventilated crawl spaces or ventilated attic spaces, provided those spaces can provide unobstructed openings to the outdoors. The exterior air intake shall not be located within the garage or basement of the dwelling nor shall the air intake be located at an elevation higher than the firebox. Mechanical and gravity outside air intake openings shall be located a minimum of 10' from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks. Where a source of contaminant is located within 10' of an intake opening, such opening shall be located a min. of 2' below the contaminant source. Exhaust from dwelling units, toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

16. **APPLIANCE INSTALLATION:** IRC Chapter M12, Chapter M 13, M2005, IMC Section 303, and UPC, Section 308 & 309. Appliances shall be listed and labeled for the application in which they are installed and used. A permanent factory-applied nameplate shall be affixed to appliances with information listed in accordance to M1303. The standards for liquefied petroleum gas installations shall be the 2004 Edition of NFPA 58 (Liquefied Petroleum Gas Code) and the 2006 Edition of ANSI Z223.1/NFPA 54 (National Fuel Gas Code).

The manufacturer's operating and installation instructions shall remain attached to the appliance. Fuel-fired appliances shall not be located in, or obtain combustion air from, sleeping rooms, bathrooms, toilet rooms, or storage closets. *Exception: 1) direct vent appliances that obtain all combustion air from the outdoors or 2) Appliances located in a dedicated enclosure in which combustion air is taken directly from the outdoors in accordance with IMC, section 703. Access to such enclosure shall be through a WSEC approved solid door, weatherstripped and equipped with an approved self-closing device.* Appliances shall be accessible for inspection, service, repair, and replacement without removing permanent construction, other appliances, or other piping or ducts not connected to the appliance. Appliances shall not be installed in a location where

subject to mechanical damage unless protected by approved barriers.

Appliances designed to be in fixed positions shall be anchored or strapped to resist horizontal displacement caused by earthquake motion in an approved manner. Strapping shall be at points within the upper 1/3 and lower 1/3 of the appliances vertical dimensions. At the lower point the strapping shall maintain a minimum distance of 4-inches above the controls.. Fuel-fired furnaces and boilers installed in closets and alcoves shall be listed for such installation. Equipment installed in outdoor locations shall be either listed for outdoor installation or provided with protection from outdoor environment factors that influence operability, durability and safety of the equipment. Appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than 24-inches wide and large enough to allow removal of the largest appliance in the space, provided there is a level service space of not less than 30-inches deep and the height of the appliance, but not less than 30-inches, at the front or service side of the appliance with the door open. Attics containing appliances requiring access shall have an opening and a clear unobstructed passageway large enough to allow removal of the largest appliance, but not less than 30-inches high and 22-inches wide and not more than 20-feet long when measure from the opening to the appliance. The passageway shall have continuous solid flooring not less than 24-inches wide. A level service space at least 30-inches x 30-inches along all sides. Appliances located in underfloor spaces shall have an unobstructed passageway large enough to remove the largest appliance, but not less than 30-inches high and 22-inches wide, nor more than 20-feet long, measured from the opening to the appliance. A level service space at least 30-inches x 30-inches along all sides. If the service space exceeds 12-inches below the adjoining grade, the walls on the passageway shall be lined with concrete or masonry extending 4-inches above the adjoining grade. Appliance supported from the ground shall be level and firmly supported on a concrete slab. Appliances suspended from the floor shall have a clearance of not less than 6-inches from the ground. A luminaire, controlled by a switch at the passageway opening shall be installed near underfloor and attic appliances.

17. **APPLIANCES LOCATED IN GARAGE:** IRC Section M1307, IMC Section 303.4, 304.3. Appliances located in a garage, carport or other location where subject to mechanical damage shall be protected with approved barriers. Vehicle barrier systems for passenger cars shall be designed to resist a single load of 6,000 lbs. Applied horizontally in any direction to the barrier system and shall have anchorage or attachment capable of transmitting this load to the structure. For design of the system, the load shall be assumed to act at a minimum height of 1'6" above the floor or ramp surface on an area not to exceed 1 sq. ft. Equipment and appliances having an ignition source shall be elevated such that the source

of ignition is not less than 18" above the floor surface on which the equipment or appliance stands. Rooms or spaces that are not part of the living space of a dwelling unit and that communicate with the private garage through openings shall be considered to be part of the garage and appliances located in the space shall be elevated as specified above.

18. **WATER HEATERS:** IRC Section M1307.2, M2005, IRC Chapter 28, and UPC Chapter 5 & 608. When water heaters or hot water storage tanks are installed in locations where leakage of the tanks or connections will cause damage, the tank or water heater shall be installed in a galvanized steel pan having a minimum thickness. The pan shall be at least 1.5" deep and with a 3/4" diameter drain to the exterior of the building not less than 6" and not more than 24" above the adjacent ground surface. Temperature and pressure relief valves shall be drained to the outside of the building. Drain may not be trapped and must terminate not more than 2' nor less than 6" above the ground or the flood level of the area receiving the discharge and pointing downward. Water heaters shall be anchored or strapped to resist horizontal displacement due to earthquake motion. *Twenty-two (22) gage x 3/4" strapping shall be used and be placed at points within the upper one-third (1/3) and lower one-third (1/3) of its vertical dimensions. At the lower point, a minimum distance of 4" shall be maintained above the controls. Lag screws not less than 1/4" in diameter must be used to anchor the restraints to the wall and each lag screw must have at least 1-1/2" thread penetration into a stud wall. A flat washer must be installed between each lag screw and the strap for reinforcement.* When the water supply system is provided with a pressure regulating device or check valve a properly sized expansion tank shall be installed per manufacturer specifications. Check with your water purveyor. Water heaters used to supply both potable hot water and hot water for space heating shall be installed in accordance with IRC Chapter 24, Uniform Plumbing Code, and manufacturer's installation instructions. In addition combination space and service water heaters shall have an Energy Factor (EF) or Combined Annual Efficiency (CAE) not less than that specified in WSEC Section 504.2.1. Service water heating systems shall be equipped with automatic temperature controls and shall be set to 120°F. WSEC Section 504.2.1 requires that all electric water heaters shall be placed on an R-10 pad when located in an unheated space or on a concrete floor. Water heaters used for space heating shall be suitable for use with potable water in accordance to IRC, Chapter 29. Water heaters that will be used

19. **LPG (PROPANE) APPLIANCES & TANKS:** IRC Chapter 13 and Chapter 24, & IMC Section 303.7. Appliances installed in pits or excavations shall not come in direct contact with the surrounding soil. The sides of the pit shall be held back a minimum of 12" from the appliance. Where the depth exceeds 12" below the adjoining grade, the walls of the pit or excavation shall be

lined with concrete or masonry. Containers for storage of LPG shall be installed in accordance with the Fire Code, see details attached.

20. **MANUFACTURER'S SPECS:** IRC Section M1302, M1303, and IMC 304.1. All appliances shall be listed and bear a permanent factory applied nameplate(s) affixed to the appliances with manufacturer's name or trademark, model number, serial number, and seal or mark of testing agency. The installer shall leave the manufacturer's installation and operating instructions attached to the appliance.
21. **VACUUM BREAKERS:** UPC Section 603.4.7. Potable water outlets with hose attachments other than water heater drains, and clothes washer connections shall be protected by a listed non-removable backflow preventer, a non-removable frost-free hose bib type vacuum breaker, or an atmospheric vacuum breaker installed at least 6" above the highest point of usage located on the discharge side of the last valve.
22. **TRAP PRIMERS:** UPC Section 1007. Floor drains or similar traps connected to the drainage system and subject to infrequent use shall be protected with a trap seal primer and shall be accessible for maintenance.
23. **GARAGE/DWELLING DOOR/OPENINGS:** IRC Section R309.1. Openings between the garage and residence shall be equipped with solid wood doors not less than 1-3/8 inches (35mm) in thickness, solid or honeycomb core steel doors not less than 1-3/8" thick, or 20-minute fire-rated doors.
24. **GARAGE/DWELLING SEPARATION:** IRC Section R309.2, R309.1.1. The garage shall be separated from the residence and its attic area by not less than 1/2" gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than 5/8" Type X gypsum board or equivalent. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall also be protected by not less than 1/2" gypsum board or equivalent. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum 26-gage sheet metal or other approved material and shall have no openings into the garage. Penetrations shall be protected by filling the opening around the penetrating item with approved material to resist the free passage of flame and products of combustion. Garages located less than 3-feet from a dwelling unit on the same lot shall be protected with not less than 1/2-inch gypsum board applied to the interior side of the exterior walls that are within this area. Openings shall meet the same protection as required in R309.1.
25. **SEPARATION BETWEEN DWELLING UNITS:** IRC Section 317. Walls and floors assemblies separating dwelling units in 2-family dwellings shall not be less than 1-hr fire-resistive rating.

26. **FIRE-RESISTANCE OF EXTERIOR WALLS:** Washington State Amendment to R302, R309. Exterior walls with a fire separation distance less than 3-feet shall have not less than a 1-hour fire-resistive rating with exposure from both sides. Projections shall not extend to a point closer than 2-feet from the line used to determine the fire separation distance. *Exception: Detached garages accessory to a dwelling located within 2' of a lot line may have roof eave projections not exceeding 4". Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. These provisions shall not apply to walls perpendicular to the line used to determine the fire separation distance. Exception: Tool and storage shed, playhouses and similar structures exempted from permits by R105.2 or City of Aberdeen ordinance are not required to provide wall protection based on location on the lot. Projections beyond the wall line shall not extend over the lot line.* Openings shall not be permitted in the exterior wall of a dwelling or accessory building with a fire separation distance less than 3-feet. *Exception: Foundation vents installed in compliance with this code are permitted.*
27. **FLOOR AREA:** IRC Section R304, R306. Every dwelling unit shall have at least one habitable room with not less than 120 square feet of gross floor area. Other habitable rooms except kitchens shall have an area of not less than 70 square feet. Habitable rooms shall not be less than 7-feet in any dimension. *Exception: Kitchens.* Every dwelling unit shall be provided with a water closet, lavatory, bathtub or shower, kitchen area with a separate sink, be connected to an approved sewage disposal system, and shall be connected to an approved water supply with hot and cold water.
28. **MINIMUM CEILING HEIGHTS:** IRC R305. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than 7-feet, measured from the finished floor to the lowest projection from the ceiling. *Exceptions: 1) Beams and girders spaced not less than 4-feet on center may project not more than 6-inches below the required ceiling height, 2) Ceilings in basements without habitable spaces may project to within 6'8" of the finished floor; and beams, girders, ducts or other obstructions may project within 6'4" of the finished floor. 3) For rooms with sloped ceilings, at least 50% of the required floor area of the room must have a ceiling height of at least 7-feet and no portion of the required floor area as specified in R304 may have a ceiling height of less than 5-feet. 4) Bathrooms shall have a min. ceiling height of 6'8" over the fixture and at the front clearance area for fixtures as shown in figures R307.1. A shower or tub equipped with a showerhead shall have a minimum ceiling height of 6'8" above the area 30-inches x 30-inches at the showerhead.*
29. **ATTIC ACCESS:** IRC R807.1. Attics that exceed 30 sq. ft. and have a vertical height of 30" or greater must be provided with minimum access openings of not less than 22" x 30". The attic access shall be located in a hallway or other readily accessible location with a 30" minimum unobstructed headroom in the attic space above the access opening.
30. **EXTERIOR DOORS/EXITS:** IRC R311.4.1. At least 1 exit doorway shall be side hinged and not less than 3-feet in width and not less than 6'8" in height. The exit door shall provide direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. Access to habitable levels not having an exit shall be by a ramp or a stairway in accordance to applicable IRC sections 311.6 or 311.5. Egress doors shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.
31. **LANDINGS AT DOORS AND STAIRWAYS:** IRC R311.4.3, R311.5.4. There shall be a floor or landing on each side of each exterior door. The floor or landing at the exterior door shall not be more than 1 1/2" lower than the top of the threshold. The landing shall be permitted to have a slope not to exceed .25 unit vertical in 12 units horizontal (1:48). *Exception: 1) Where a stairway of two or fewer risers is located on the exterior side of a door, other than the required exit door, a landing is not required for the exterior side of the door provided the door, or other than exterior storm or screen door does not swing over the stairway. 2) The exterior landing at an exterior doorway shall not be more than 7-3/4" below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing. 3) The height of floor at exterior doors other than the required exit door shall not be more than 7 3/4-inches lower than the top of the threshold.* The width of each landing shall not be less than the door served and have a minimum dimension of not less than 36" measured in the direction of travel. There shall be a floor or landing at the top and bottom of each stairway. *Exception: A floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs.* A flight of stair shall not have a vertical rise greater than 12-feet between floor levels or landings. Landings shall be the same width of the stairway served and at least 36-inches measured in the direction of travel.
32. **GUARDS:** IRC Section R312. R301.5 Porches, balconies, ramps, or raised floor surfaces located more than 30" above grade or a floor below shall have guards not less than 36" in height. Open sides of stairs with a total rise of more than 30" above the floor or grade below shall have guards not less than 34" in ht. Measured vertically from the nosing of the treads. Open side of guards shall be designed such that a sphere 4" in diameter cannot pass through. *Exceptions: 1) The triangular openings formed by the riser, tread and bottom rail of a*

guard at the open side of a stairway are permitted to be of such size that sphere 6-inches cannot pass through. 2) Openings for required guards on the sides of stair treads shall not allow a sphere 4-3/8 inches to pass through. Handrail assemblies and guards shall be able to resist a single concentrated load of 200 lbs., applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building. Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 lbs. on an area equal to 1 sq. ft., including openings and space between rails.

33. **HANDRAILS:** IRC Section R311.5.6, R311.5.1 All stairways with 4 or more risers shall have at least one handrail. Such handrails shall be placed not less than 34" nor more than 38" above the nosing of the treads. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser to a point directly above the lowest riser. Handrail ends shall be returned or terminate in newel posts or safety terminals. Handrails adjacent to the wall shall have a space not less than 1 1/2" between the wall and the handrail. Circular handrails shall have an outside diameter of at least 1 1/4" and not greater than 2". Handrails with a perimeter greater than 6 1/4" shall provide a graspable finger recess area on both sides. See handrail option in IRC Section 311.5.6.3 for additional handgrip requirements. Handrails shall not project more than 4 1/2" on either side of the stairway. See #34, stairway width for additional information.
34. **STAIR WIDTH:** IRC Section R311.5.1 Stairways shall not be less than 36" in clear width at all points above the handrail height and below the required headroom height. Handrails shall not project more than 4 1/2" on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31 1/2" where the handrail is installed on one side and 27" where handrails are installed on both sides.
35. **STAIR TREADS & RISERS:** IRC Section 311.5.3 The maximum riser height shall be 7 3/4". The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8". The minimum tread depth shall be 10". The tread depth within any flight of stairs shall not exceed the smallest by more than 3/8". A nosing not less than 3/4" but not more than 1 1/4" shall be provided on stairways with solid risers. Open risers are permitted, provided that the opening does not permit the passage of a 4" diameter sphere. *Exception: Nosing is not required where the tread depth is at least 11". The opening between adjacent treads is not limited on stairs with a total rise of 30" or less.*
36. **STAIR HEADROOM CLEARANCE:** IRC R311.5.2 All parts of the stairway shall not be less than 6'8"

measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform. See exception for spiral stairways.

37. **USABLE SPACE UNDER STAIRS:** IRC Section R311.2.2 Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with 1/2" gypsum board.
38. **ILLUMINATION:** IRC Section R303.6, R311.5.7 All interior and exterior stairways shall be provided with a means to illuminate the stairs, including landings and treads. Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. Exterior stairways shall be provided with a light source located in the immediate vicinity of the top of the landing of the stairway. Exterior stairways providing access to a basement from the outside grade level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway. Where lighting outlets are installed in the interior stairways, there shall be a wall switch at each floor level to control the lighting outlet where the stairway has 6 or more risers. The illumination of exterior stairways shall be controlled from inside the dwelling unit.
39. **SPECIAL STAIRWAYS:** IRC Section R311.5.3.2, R311.5.8.1. Circular stairways, spiral stairways, winders and bulkhead enclosure stairways shall comply with all requirements of stairways except: Winder treads shall have a minimum tread depth of 10" measured at a point 12" from the side where the treads are narrower. Winder treads shall have a minimum tread depth of 6" at any point. Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a 7 1/2" minimum tread depth at 12" from the narrower edge. All treads shall be identical, and the rise shall be no more than 9 1/2". A minimum headroom of 6 feet 6 inches shall be provided. **Note: Washington State Amendment to IRC R311.1: Stairs and ladders are permitted within an individual dwelling unit used for access to areas of 200 sq. ft. or less, and not containing the primary bathroom or kitchen.**

**STRUCTURAL**

40. **FOUNDATION FOOTING SIZE:** IRC Section R403. Assume load-bearing value of soil 1500 psf unless proven otherwise.

- Supporting 1 floor: minimum 6"x 18".
- Supporting 2 floors: minimum 6" x 24".
- Supporting 3 floors: minimum 8" x 24".

Spread footing projections shall be at least 2" & shall not exceed the thickness of the footing.

IBC1805.4.2 (c) Interior-stud-bearing walls are permitted to be supported by isolated footings. The footing width and length shall be twice the width shown above and footings shall be spaced not more than 6 feet on center.

41. **FOOTING REINFORCEMENT:** IRC Section R403.1, Standard Hook ACI Section 611.7.1.5. Concrete footings shall have bottom reinforcement located a minimum of 3-inches clear from the bottom of the footing. Where a construction joint is created between a concrete footing and stem wall, a min. #4, grade 60, vertical bar shall be provided at not more than 4-feet on center. The vertical bar shall extend to 3-inches clear of the bottom of the footing, have a standard hook and extend a minimum of 14-inches into the stem wall. The standard hook shall have a 3-inch return and shall engage the center-footing bar. The vertical bar shall be tied in place at inspection.

42. **FOUNDATION WALL SIZE:** IRC Tables R404.1.1(1), R404.1.1(5), & Section 404.1.4 Concrete and plain masonry foundation walls located in Seismic Design Categories D1 and D2, as established in Table R301.1(1), shall comply with the following: 1) Minimum reinforcement shall consist of one #4 horizontal bar located in the upper 12" of the wall (two bars if wall greater than 8' in height), 2) Wall height shall not exceed 10', 3) Height of unbalanced backfill shall not exceed 4'0" (except per table 404.1.1(5)), and 4) A minimum thickness of 7 1/2" is required for concrete foundation walls except that a minimum thickness of 6" shall be permitted for concrete foundation walls with a maximum height of 4'6" provided the minimum specified compressive strength of concrete,  $f_c$ , is 3000 psi. 5) Masonry foundation walls shall be a minimum of 8" thick.

Vertical reinforcement for masonry stem walls shall be tied to the horizontal reinforcement in the footings. Masonry stem walls located in Seismic Design Categories D1 and D2 shall have a min. vertical reinforcement of one #4 bar located a max. of 4' o.c. in grouted cells.

Foundation walls located in Seismic Design Categories D1 and D2, as established in Table R301.2(1), supporting more than 4' of unbalanced backfill or exceeding 8' in

height shall be constructed in accordance with Table R404.1.1(5) and shall have two #4 horizontal bars located in the upper 12" of the wall.

43. **STEPPED FOUNDATIONS:** IRC Section 602.11.3. Where stepped foundations occur, the following requirements apply: 1) Where the height of a required braced wall panel that extends from the foundation to floor above varies more than 4', the braced wall panel shall be constructed in accordance to figure R602.11.3. 2) Where the lowest floor framing rests directly on a sill bolted to a foundation not less than 8' in length along a line of bracing, the line shall be considered as braced. The double plate of the cripple stud wall beyond the segment of footing that extends to the lowest framed floor shall be spliced by extending the upper top plate a minimum of 4' along the foundation. Anchor bolts shall be located a maximum of 1' and 3' from the step foundation. 3) Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements for a story shall apply. (see item # 62) 4) Where only the bottom of the foundation is stepped and the lowest floor framing rests directly on a sill bolted to the foundations, the requirements of Section R602.11.1 shall apply. (see item # 46).
44. **FOOTING DEPTH:** IRC Section R403.1.4.1, 403.1.4.2. all exterior footings shall be placed at least 12" below undisturbed ground. Interior footings supporting bearing or bracing walls and cast monolithically with a slab on grade shall extend to a depth of less than 12" below the top of slab.
45. **CRIPPLE WALL BRACING:** IRC Definition, Sections R602.10.2, R602.10.2.3, & R602.10.11.1 & R602.10.11.2. In Seismic Design Category D2 Cripple walls shall be braced in accordance with Table R602.10.1. In any Seismic Design Category, cripple walls are permitted to be redesignated as the first story walls for purposes of determining wall-bracing requirements. If the cripple walls are redesignated, the stories above the redesignated story shall be counted as the second and third stories respectively. Where **interior braced wall lines** occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be 1 1/2 times the length required by Table R602.10.1. Where cripple walls are braced using method 3 of Section R602.10.3 (wood structural panel) cannot provide this additional length, the capacity of the sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4" o.c. Adhesive attachment of wall sheathing shall not be permitted in Seismic Design Categories D1 and D2.
46. **FOUNDATION ANCHORAGE:** IRC Section 403.1.6, R602.11.1. When braced wall panels are supported directly on continuous foundations, the wall wood sill plate or cold-formed steel bottom track shall be anchored to the foundation in accordance to the following: The wood sole plates at exterior walls on monolithic slabs and

wood sill plates shall be anchored to the foundation with ½" anchor bolts spaced a maximum of 6' o.c. There shall be 2 bolts per plate section with one bolt located not more than 12" or less than 7 bolt diameters (3 ½" typical) from each end of the plate section. Where interior braced wall lines are required (seismic zones D1 & D2) to be supported by continuous foundations in Section 403.1.2, ½" anchor bolts shall be spaced not more than 6' o.c. and located within 12" from the ends of each plate section. Anchor bolts shall be at least ½" in diameter and shall extend a minimum of 7" into masonry or concrete.

Interior bearing wall sole plates on monolithic slab foundations shall be positively anchored with approved fasteners. A nut and washer shall be tightened on each bolt to the plate using ¼" x 3" x 3" plate washers. At all braced wall lines sills and sole plates shall be protected against decay. Cold-formed steel framing systems shall be fastened to the wood sill plate or anchored directly to the foundation as required in Section R505.3.1 or R603.1.1. *Exceptions:* (1) Foundation anchor straps, spaced as required to provide equivalent anchorage to ½"(13mm) diameter anchor bolts. (2) Walls 24 inches (610mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with a minimum of one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels per Figure R602.10.5 at corners. (3) Walls 12 inches (305mm) total length or shorter connecting offset braced wall panels shall be permitted to be connected to the foundation without anchor bolts. The wall shall be attached to adjacent braced wall panels per Figure R602.10.5 at corners.

47. **DAMP-PROOF FOUNDATION WALLS:** IRC Section R406. 1 Except where required to be waterproofed by section R406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be waterproofed from the top of the footing to the finished grade. R406.2: In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose usable spaces located below grade shall be waterproofed with a membrane extending from the top of the footing to the finished grade. The membrane shall consist of 2-ply hot mopped felts, 55-pound roll roofing, 6-mil polyvinyl chloride, 6-mil polyethylene, 40-mil polymer-modified asphalt or 60-mil flexible polymer cement. The joints in the membrane shall be lapped and sealed with an adhesive compatible with the waterproofing membrane. See exceptions for additional information.

48. **FOUNDATION DRAINAGE:** IRC Section R401.3, R405. R405.1: Surface drainage shall be diverted to an approved point of collection so as to not create a hazard. Lots shall be graded so as to drain surface water away from foundation walls. The grade away from foundation walls shall fall a minimum of 6" within the first 10.' *Exception:* Where lot lines, walls, slopes or other physical barriers prohibit 6" of fall within 10' drains or

swales shall be provided to ensure drainage away from the structure. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable spaces located below grade. Drainage tiles, gravel, or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least 1-foot beyond the outside edge of the footing and at least 6 inches above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum 2 inches of washed gravel or crushed rock at least one sieve larger than the tile joint opening or perforation and covered with not less than 6 inches of the same material.

49. **FOOTING/PIERS ON OR ADJACENT TO SLOPES:** IRC Section 403.1.7. The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical in 3 units horizontal (33.3-percent slope) shall conform to Sections R403.1.7.1 through R403.1.7.4. Buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Where the existing slope is steeper than one unit vertical in one unit horizontal (100% slope), the toe of the slope shall be assumed to be at the intersection of the horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle 45 degrees to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope. Footings on or adjacent to slopes shall be founded in material with an embedment and setback from the slope surface to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in Section R403.1.7.4 and Figure R403.1.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than one unit vertical in one unit horizontal (100% slope), the required setback shall be measured from an imaginary plane 45 degrees to the horizontal, projected upward from the toe of the slope. Footings adjacent to slopes shall be founded in firm material with an embedment and setback sufficient to provide vertical and lateral support for the footing without detrimental settlement. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a qualified engineer to demonstrate that the intent of the code has been satisfied. Such an investigation (geotechnical evaluation) shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.
50. **CHIMNEY FOUNDATION & SEISMIC REINFORCING:** IRC Sections 1001, R1002, & R1003. When an approved design is not provided, footings for

masonry and concrete fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12" thick, and extend 6-inches beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural, undisturbed earth or engineered fill below the frost depth, at least 12" below finished grade. Masonry and concrete chimneys shall be reinforced in accordance to Chapter 10.

51. **UNDER-FLOOR VENTILATION:** WAC amendment to IRC Section R408.1 and R408.2. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls having a net area of not less than 1 square foot for each 300 square feet of under-floor space area. In addition, a ground cover shall be installed in accordance to item #96. One ventilating opening shall be within 3-feet of each corner of the building, except one side of the building shall be permitted to have no ventilation openings. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed 1/4": 1) perforated sheet metal plates not less than .070" thick, 2) Expanded sheet metal plates not less than .047" thick, 3) Cast iron grills or grating, 4) Extruded load-bearing brick vents, 5) Hardware cloth of .035" wire or heavier, 6) Corrosion-resistant wire mesh, with the least dimension being 1/8". See exceptions for additional options.
52. **WOOD IN CONTACT WITH CONCRETE & MASONRY:** IRC Section R319.1 #2. All wood framing members that rest on concrete or masonry exterior foundation walls and are less than 8" from the exposed ground require the use of naturally durable wood or wood that is preservative treated accordance with AWP A U1 for the species, product, preservative, and end use. Preservatives shall be listed in Section 4 of AWP A U1.
53. **COLUMNS AND POSTS:** IRC Section R319.1.3, R319.1.4 & R407.3. Posts, poles and columns supporting permanent structures that are embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather shall be approved pressure preservatively treated wood suitable for ground contact. Wood columns shall be approved wood of natural decay resistance or approved pressure preservatively treated wood. *Exceptions:* 1) Posts or columns which are exposed to the weather or located in basements or cellars, supported by concrete piers or metal pedestals projecting 1" above the floor or finished grade and 6" above exposed earth, and are separated by an approved impervious moisture barrier. 2) Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than 8" from the exposed earth and the earth is covered by an impervious moisture barrier. Columns shall be restrained to prevent lateral displacement at the bottom end. Wood

columns shall not be less in nominal size than 4" x 4" or approved equivalent.

54. **GIRDERS ENTERING MASONRY OR CONCRETE WALLS:** IRC Section R319.1 #4. The ends of wood girders entering exterior concrete or masonry walls shall be provided with a 1/2" airspace on tops, sides and ends unless an approved species and grade of lumber specified in Sections R319.1 & R319.2 and listed in #56 of this checklist is used.
55. **POST-BEAM CONNECTIONS/FASTENING:** IRC Section R502.9, R301. Where post and beam or girder construction is used to support floor framing, positive connections shall be provided to ensure against uplift and lateral displacement. The construction of buildings and structures shall result in a system that provides a complete load path that meets all requirements for the transfer of all loads from their point of origin through their load resisting elements to the foundation.
56. **MINIMUM STANDARDS & PROTECTION AGAINST DECAY:** IRC Sections R319.1, R319.2, & R319.3, R502.1, R602.1, R802.1, R202. Areas subject to decay and where required, the use of an approved species and grade of lumber shall be required, including wood pressure treated in accordance with AWP A U1, listed in Section 4, or naturally durable wood such as decay resistant redwood, black locust, black walnut or cedars. Lumber and plywood required to be pressure preservatively treated in accordance with Section 319.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that had been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program. Load bearing dimension lumber used for joists, beams, girders, studs, plates, headers, rafters, trusses, and ceiling joists, including, end-jointed lumber, pre-fabricated I-joists, structural glue-laminated timber, structural log members, wood structural panels, fiberboard sheathing (when used structurally), hardboard siding (when used structurally), particleboard, preservative treated wood, fire-retardant-treated wood, hardwood plywood, shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the same requirements shall be accepted. **FASTENERS:** Fasteners for pressure preservative and fasteners for pressure-preservative and fire-retardant-treated wood shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. The coating weights for zinc-coated fasteners shall be in accordance to ASTM A 153. See also manufacturer specifications or distributor specific installation instructions or recommendations. *Exception:* 1) 1/2" diameter or larger steel bolts (where required by location). 2) Fasteners other than nails and timber rivets

shall be permitted to be mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55, minimum. Sill plate need not be pressure treated if sill plate installed over an approved moisture barrier such as 30 lb. Felt or equivalent and the sill plate is 8" or more above grade.

57. **FLOOR FRAMING:** IRC Chapter 5, Section R502.6, 502.7. The ends of each joist, beam or girder shall have not less than 1- 1/2" bearing on wood or metal and not less than 3" on masonry or concrete except where supported on a 1" x 4" ribbon strip and nailed to the adjacent stud or by the use of approved joist hangers. Joist framing from opposite sides of a beam or partition shall lap a minimum of 3" and shall be nailed together with three 10d-face nails. A wood splice with strength equal to or greater than that provided by the nailed lap is permitted. Joists framing into the side of a wood girder shall be supported by approved framing anchors or on ledger strips not less than 2-inches x 2-inches. Joists shall be supported laterally at the ends and at each intermediate support by full depth solid blocking not less than 2" nominal thickness; or by attachment to a full-depth header, band or rim joist, or to an adjoining stud; or shall be otherwise provided with lateral support to prevent rotation. Joists exceeding a nominal 2" x 12" shall be supported laterally by solid blocking, diagonal bridging (wood or metal), or a continuous 1" x 3" strip nailed across the bottom of joists perpendicular to joists at intervals not exceeding 8'0". See Figure R502.2 for floor framing information and Tables 502.3.1(1), R502.3.1(2), R502.3.3(1) and R502.3.3(2) for allowable spans.

58. **JOISTS UNDER BEARING PARTITIONS:** IRC Section R502.4. Joists under parallel bearing partitions shall be of adequate size to support the load. Double joists, sized to adequately support the load, that are separated to permit the installation of piping or vents shall be full depth solid blocked with lumber not less than 2" in nominal thickness spaced not more than 4' o.c. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless joists are of sufficient size to carry the additional load.

59. **UNDER-FLOOR CLEARANCE / REMOVAL OF DEBRIS:** IRC Section R319.1 #1, R408.5. When floor joists or the bottom of a wood structural floor are located within 18" or wood girders are located within 12" to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation, all components of the floor assembly shall be wood approved in areas subject to decay as identified in #56 of this checklist. Included are the posts, beams or girders, joists and sub-floor. The under-floor grade shall be cleaned of all vegetation and organic material. All wood forms used for placing concrete and construction materials shall be removed before the building is occupied or used for any purpose.

60. **UNDER-FLOOR ACCESS:** IRC Section R408.4, M1305.1.4. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 18" x 24". Openings through a perimeter wall shall be at least 16" x 24". When any portion of the through wall access is below grade, an areaway not less than 16" x 24" shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. Where appliances are located under floors a rough-framed access shall be provided not less than 22-inches x 30-inches. Access shall be unobstructed by pipes, ducts or similar construction.

61. **WALL FRAMING:** IRC Sections R602.3.1, R602.3.2, R602.3.3, R 602.3.4, R602.6 & R602.9. The size, height, and spacing of all other wood-framing studs shall be in accordance with Table R602.3(5). *Exception: 1) Utility grade studs shall not be spaced more than 16" on center, support more than a roof and ceiling, and shall not exceed 8-feet in height for exterior and load bearing walls or 10' for interior non-bearing walls. 2) Studs greater than 10' in height that are in accordance with Table R602.1.3.* Studs shall be placed with their wide dimension perpendicular to the wall. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset at least 24". Joints in plates need not occur over studs. Plates shall be a nominal 2" in depth and have a width at least equal to the width of studs. Where joists, trusses, or rafters are spaced more than 16" o.c. and the bearing studs are spaced 24" o.c. such members shall bear within 5" of the studs beneath. Studs shall have full bearing on a 2-inch nominal or larger plate or sill having a width at least equal to the width of the studs.

**Drilling & notching - studs:** *Notching:* Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25% of the stud width. Studs in non-bearing partitions maybe notched to a depth not to exceed 40% of a single stud width. *Drilling:* Any stud may be bored or drilled, provided that the diameter of the resulting hole is not more than 60% of the stud width, the edge of the hole is no closer than 5/8" to the edge of the stud, and the hole is not located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over 40% and up to 60% shall be doubled with no more than 2-successive doubled studs bored (See Figure R602.6.(1) and R602.6(2). *Exception:* Use of approved stud shoes is permitted when they are installed in accordance with the manufacturer's recommendations. and R602.6 for additional details.

**Drilling and notching of top plate:** When piping or ductwork is placed in or partly in an exterior wall or interior load bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50% of its width, a galvanized metal tie of not less than .054-inch thick and 1 1/2 inches wide shall be fastened across the



plate at each side of the opening with not less than 8-16d nails at each side (See figure R602.6.1). **Foundation cripple walls** shall be framed of studs not less in size than the studding above. When exceeding 4'0" in height, such walls shall be framed of studs having the size required for an additional story. Cripple walls with a stud height less than 14" shall be sheathed on at least one side with a wood structural panel that is fastened to both the top and bottom plates in accordance with Table R602.3(1) or the cripple walls shall be constructed of solid blocking. Cripple walls shall be supported on continuous foundations.

62. **WALL BRACING:** IRC and WAC Amendments  
Section 602.10. All exterior walls shall be braced in accordance to Section 602.10 and 602.11. In addition, interior braced wall lines shall be provided in accordance with Section R602.10.11 and R403.1.2. Where a building or a portion thereof, does not comply with one or more of the bracing requirements in Sections R602.10 through R602.10.9 or meets the definition of an irregular building in Section R301.2.2.2.2 those portions shall be designed and constructed in accordance with accepted engineering practice. Cripple wall bracing shall be provided in accordance R602.10.2 and 602.10.11.4. Braced wall lines shall consist of braced wall panel construction in accordance with Section R602.10.3, R602.10.5 and R602.10.6. Braced wall panels shall begin no more than 8'0" from each end of a braced wall line (R602.10.11.2) provided one of the following exceptions is satisfied: 1) A minimum 24-inch wide panel is applied to each side of the building corner and the two 24-inch panels at the corner shall be attached to framing in accordance to R602.10.5; or 2) The end of each braced wall panel closest to the corner shall have a tie down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below. The tie-down device shall be capable of providing uplift allowable design value of at least 1800 lbs. The tie-down device shall be installed in accordance with the manufacturer's recommendations. Braced wall panels that are counted as part of a braced wall line may have offsets, out of plane of up to 4'0" provided that the total out-to-out offset dimension in any braced wall line is not more than 8-feet. Spacing between braced wall lines shall not exceed 25-feet o.c. in both the longitudinal and transverse directions. Braced wall panel bottom (sole) plates shall be fastened to the floor framing and top plates shall be connected to the framing above in accordance with Table R602.3 (1). Sill plates shall be fastened to the footing, foundation or slab in accordance with Sections R403.1.6 and R602.11. Where joists are perpendicular to braced wall lines below, blocking shall be provided over and in line with braced wall panels. Where joists are parallel to braced wall lines above or below, blocking shall be provided over and in line with the braced wall panels. Where joists are parallel to braced wall lines above or below, a rim joist or parallel framing member shall be provided at the wall to permit fastening per Table R602.3 (1). All vertical joints of

panel sheathing shall occur over, and be fastened to, common studs. Horizontal joints in braced wall panels shall occur over, and be fastened to, common blocking of a minimum 2-inches nominal thickness. Plate washers a minimum of 1/4" x 3" x 3" shall be provided between foundation sill plate and the nut. Interior braced wall panels shall be fastened to floor and roof framing in accordance with Table R602.3 (1), to required foundations in accordance with Section R602.11.1, and in accordance with the following: 1) Floor joists parallel to the top plate shall be toe-nailed to the top plate with at least 8d nails spaced a maximum of 6" o.c. 2) Top plate laps shall be face-nailed with at least 8-16d nails on each side of splice. See Tables R602.10.1, R602.10.5 for additional wall bracing information.

63. **OPENINGS IN EXTERIOR & INTERIOR WALLS (HEADERS):** IRC Section R602.7, R502.5 & R502.6. Headers shall be provided over each opening in exterior-bearing walls. Headers shall be of two pieces of nominal 2-inch framing lumber set on edge as permitted in tables R502.5 (1) and R502.5 (2) and nailed together in accordance with Table 2304.9.1 or of solid lumber of equivalent size. Exterior headers not listed in the tables shall be designed to support the loads specified in Table R301.5. Each end of all headers shall have at least 1-1/2" of bearing for the full width. A single flat 2"x4" member be used as header in interior or exterior nonbearing walls for openings up to 8-ft in width if the vertical distance to the parallel nailing surface above is not more than 24-inches.
64. **FIREBLOCKING & DRAFTSTOPPING:** IRC Sections R602.8, R502.12, R1001.12, R1003.19. *FIREBLOCKING* shall be installed to cut off all concealed vertical and horizontal draft openings and shall form an effective fire barrier between stories, between a top story and the roof space. Fireblocking shall be provided in wood-frame construction in the following locations: 1) In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs as follows: a) Vertically at the ceiling and floor levels. B) Horizontally at intervals not exceeding 10 feet 2) At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings. 3) In concealed spaces at stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R311.2.2. 4) At openings around vents, pipes and ducts, cables and wires at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion. 5) For the fireblocking of chimneys and fireplaces, see Section R1003.19. 6) Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation. Fire blocking materials shall consist of material listed in Section R602.8.1. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended. The integrity of all fireblocks shall be maintained. *DRAFTSTOPPING:* When there is

usable space both above and below a concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1000 square feet. Draftstops shall divide the concealed space into approximately equal areas. Draftstopping materials shall consist of the following materials: ½" gypsum board, 3/8" wood structural panels, 3/8" Type 2-M-W particleboard or other approved materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise approved. The integrity of draftstops shall be maintained. **CHIMNEY FIREBLOCKING:** All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between chimneys and wood joists, beams, or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

65. **EXTERIOR COVERING & ATTACHMENTS:** IRC Section R703.1, R703.4, R703.5, R703.6, R703.7, R703.8, R703.9, R703.10, R703.11. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in Section R703.8. The exterior wall envelope shall be designed and constructed in a manner that prevents accumulation of water within the wall assembly by providing a water resistant barrier behind the exterior veneer, as specified in item #66, R703.2, and a means draining water that enters the assembly to the exterior. Protection against condensation in the exterior wall assembly shall be provided in accordance with the Washington State Energy Code (WSEC) as described in item #95. Ensure proper fastening for type used, wood siding may not be less than 3/8" thick. See Table R703.4. Approved corrosion-resistant fasteners shall be provided in the exterior wall envelope in such a manner as to prevent entry of water into the wall cavity or penetration of water to the building structural framing components.
66. **WEATHER RESISTANT SHEATHING PAPER and FLASHING:** IRC Section R703.2 and R703.8. One layer of #15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type I felt or other approved water-resistant material shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2". Where joints occur felt shall be lapped not less than 6-inches. The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior envelope as described in item #65, R703.1. Exceptions: Omission of the water-resistant barrier is permitted in the following situations: 1) in detached accessory buildings. 2) Under exterior wall finish materials as permitted in Table R703.4. 3 or 3) Under paperbacked stucco lath when the paper backing is an approved weather-resistive

sheathing paper. **FLASHING:** Approved corrosion resistant flashing shall be applied shingle-fashion in such a manner to prevent entry of water into the building cavity or penetration of water to the building structural framing components. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion resistant flashing shall be installed at all of the following locations: 1) Exterior window and door openings. Flashing shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. 2) At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on bot sides under stucco copings. 3) Under and at the ends of masonry, wood or metal copings and sills. 4) Continuously above all projecting wood trim. 5) Where exterior porches, decks or stairs attach to a wall or floor assembly of wood construction. 6) At wall and roof intersections. 7) At built-in gutters.

67. **STONE AND MASONRY VENEER, GENERAL:** IRC Section R703.7. All stone and masonry veneer shall be installed in accordance with IRC Chapter 7, Table R703.4 and Figure R703.7. Such veneers installed over backing of wood or cold-formed steel shall be limited to the first story above grade and shall not exceed 5" in thickness. *Exception:* 3. For detached one- or two- family dwellings with a maximum nominal thickness of 4 inches (102 mm) of exterior masonry veneer with a backing of wood frame located in Seismic Design Category D1 and D2, exterior stone or masonry veneer, as specified in Table R703.7(2) above a noncombustible foundation. Wall bracing and holdowns at exterior and interior braced wall lines shall be in accordance with section R602.1 and R602.11 and the additional requirements of Table R703.7(2). Cripple walls shall not be permitted, and required interior braced wall lines shall be supported on continuous foundations. Anchored veneer shall be supported on footings, foundations or other noncombustible support. Wall ties shall be corrosion resistant.
68. **SIDING/EARTH SEPARATION:** IRC Section R319.1 #5. Wood siding, sheathing and wall framing on the exterior of the building used within 6" of earth shall be natural durable wood or wood that is preservative treated in accordance that specified in item #56 of this checklist. Wood or other products shall conform to the most restrictive of either manufacturer specifications or code requirements.
69. **DECKS & EXTERIOR STAIRS:** IRC Section R319.1.2, R319.1.3, R502.2.2. All wood in contact with the ground, embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather that supports permanent structures intended for human occupancy shall be naturally durable wood as specified in item #56 or approved pressure-preservative-treated wood suitable for ground contact use. In addition naturally durable wood or pressure preservative treated wood shall be used in those portions of wood members

that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances when those members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members. Such members may include: 1) Horizontal members such as girders, joists and decking. 2) Vertical members such as posts, poles and columns. 3) Both horizontal and vertical members. Field applied treatment is not an approved method. Treatment must be applied by manufacturer, see item #56 of this checklist. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to the exterior walls or other framing members, shall be designed and constructed to resist uplift.

70. **WOOD TRUSSES:** IRC Section 502.11. Wood trusses shall be designed in accordance with approved engineering practice. Engineering data and installation specifications, including the type of roofing to be used, shall be available on site at framing inspection. Roof trusses shall be supported laterally at points of bearing by solid blocking to prevent rotation and lateral displacement.
71. **RAFTERS:** IRC Sections 802.3, R802.8. Rafters shall be framed to ridge board or to each other with a gusset plate as a tie. Ridge board shall be at least 1-inch nominal thickness and not less than the cut end of the rafter. At all valleys or hips there shall be a valley or hip rafter not less than 2" nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units in 12 unit horizontal (25-percent slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams. Ceiling joists and rafters shall be nailed to each other in accordance with Tables R802.5.1(9), and the rafter shall be nailed to the top wall plate in accordance with Table R602.3(1). Ceiling joists shall be continuous or securely joined in accordance with Table R802.5.1(9) where they meet over interior partitions and nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters. Where ceiling joists are not connected to the rafters at the top wall plate, joists connected higher in the attic shall be installed as rafter ties, or rafter ties shall be installed to provide a continuous tie. Where ceiling joists are not parallel to the rafters, rafter ties shall be installed. Rafter ties shall be min. 2"x4", installed in accordance with

connection requirements in Table R802.5.1(9), or connections of equivalent capacities shall be provided, the ridge formed by these rafters shall be supported by a wall or girder designed in accordance with engineering practice. Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the attic space in accordance with Table R602.3.1. Collar ties shall be minimum of 1"x4" spaced not more than 4-ft o.c. Rafters and ceiling joists having a depth-to-thickness ratio exceeding 5 to 1 based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation.

72. **RAFTER OPENINGS:** IRC Section R802.9. Openings in roof and ceiling framing shall be framed with header and trimmer joists. When the header joist does not exceed 4', the header joist may be a single member the same size as the ceiling joist or rafter. Single trimmer joists may be used to carry a single header joist that is located within 3' of the trimmer joist bearing. When the header joist span exceeds 4', the trimmer joists and the header joist shall be doubled and sufficient cross section to support the ceiling joists or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6-ft. Tail joists over 12-ft long shall be supported at the header by framing anchors or on ledger strips not less than 2"x2."
73. **CEILING JOISTS LATERAL SUPPORT /BRIDGING:** IRC Section R802.8, R802.8.1. Rafters and ceiling joists having a depth-to-thickness ratio exceeding 5 to 1 based upon nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation. Rafters and ceiling joists having a depth-to-thickness ratio exceeding 6 to 1 based upon nominal dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or continuous 1" x 3" wood strip nailed across the rafter or ceiling joists at intervals not exceeding 8'.
74. **ROOF DRAINAGE:** IRC Section R903.4. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof. Where required for roof drainage, scuppers shall be placed level with the roof surface in a wall or parapet. Overflow drains shall discharge to an approved location and shall not be connected to roof drain lines.
75. **ROOF MATERIALS:** IRC Section R904 & R905. Roof covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels when required. Roof coverings shall be applied and installed in accordance with Section R905 and the manufacturer's installation instructions. Asphalt shingles classified using ASTM D 3161 are acceptable for use in City of Aberdeen and other areas where wind zones less than 110 mph.

76. **ATTIC VENTILATION:** IRC Section R806, Note, Washington State did not adopt Section R806.4. Enclosed attics and rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space ventilating openings protected against the entrance of rain and snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with 1/8" minimum to 1/4" maximum openings. The total net free ventilating area shall not be less than 1 to 150 of the area of the space ventilated, except that the total area is permitted to be reduced to 1 to 300, provided at least 50% and not more than 80% of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3' above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to 1 to 300 when a vapor retarder having a transmission rate not exceeding 1-perm is installed on the warm-in-winter side of the ceiling. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1" space

shall be provided between the insulation and the roof sheathing at the location of the vent.

77. **CHIMNEY HEIGHT/CHIMNEY CRICKETS:** IRC, R1003.9, R1005, R905.2.8.3. Masonry chimneys shall extend at least 2-ft higher than any portion of a building within 10-ft, but shall not be less than 3-ft. above the highest point where the chimney passes through the roof. Masonry chimneys shall be provided with crickets when the dimension parallel to the ridgeline is greater than 30" and does not intersect the ridgeline. The cricket and chimney shall be flashed and counterflashed and shall be constructed in compliance with Figure R1003.20 and Table R1003.20. Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions. A cricket or saddle shall be installed on the ridge side of any chimney or penetration of roof more than 30-inches wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

## GENERAL

78. **PREMISE IDENTIFICATION:** IRC Section R321 Approved numbers or addresses shall be provided for all new buildings in such a position as to be plainly visible and legible from the street or road fronting the property. Approved numbers or addresses shall be placed on all buildings, at the beginning of long driveways when the address is not clearly visible from the access road, or in any other areas deemed necessary by the local fire district or Fire Marshal. They shall be placed in such a position as to be plainly visible and legible from the street or road fronting the property. Said numbers shall contrast with their background. See address posting and private road signage requirement information attached.
79. **APPROVED PLANS:** IRC Sections 106.3.1, 106.4. When the building official issues a permit, the construction documents shall be approved in writing or by stamp. One set of the construction documents so reviewed shall be retained by the building official. The other set shall be returned to the applicant, shall be kept at the site of work and shall be open to inspection by the building official or his duly authorized representative. The work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.
80. **HEATING:** IRC Section 303.8 & Washington State Amendment to R303.8.2 and R303.8.3. Every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of 68° F at a point 3' above the floor and 2' from exterior walls in all habitable rooms at the design temperature. The

installation of portable heaters shall not be used to achieve compliance with this section. Primary heating sources in all new and substantially remodeled buildings shall not be dependent upon wood stoves. No used solid fuel burning device shall be installed in new or existing buildings unless such device is U.S. EPA certified or a pellet stove either certified or exempt from certification by the U.S. EPA. *Exception: Antique wood cook stoves and heaters manufactured prior to 1940.*

81. **SKYLIGHTS:** IRC Section 308.6. The following types of glazing may be used: 1) Laminated glass with a minimum .015" polyvinyl butyl interlayer for glass panes 16 sq. ft. or less in area located such that the highest point of the glass is not more than 12' above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be .030". 2) Fully tempered glass. 3) Heat-strengthened glass. 4) Wired glass. 5) Approved rigid plastics. Installed skylights shall comply with Washington State Energy Code requirements.
82. **INTERIOR FINISHES:** IRC Section R702.5 Wood veneer paneling and hardboard paneling shall be placed on wood or cold-formed steel framing spaced not more than 16-inches o.c. Wood veneer and hardboard paneling less than 1/4" nominal thickness shall have not less than 3/8-inch gypsum board backer. Wood veneer paneling not less than 1/4" nominal thickness shall conform to ANSI/HPVA HP.1. Hardboard paneling shall conform to ANSI/AHA A135.5.
83. **GYPSON WALLBOARD & GYPSON WALLBOARD FASTENING:** IRC Section R702.3,

R702.4.2 & R702.4.3, R702.3.6, Table R702.3.5. All wood framing supporting gypsum board shall not be less than 2-inches nominal thickness in the least dimension except that furring strips, not less than 1"x 2" may be used over solid backing or framing spaced not more than 24-inches o.c. When gypsum is used as a base or backer for adhesive application of ceramic tile or other required nonabsorbent material shall conform with ASTM C630 or C1178. Use of water resistant gypsum backing board shall be permitted to be used on ceilings where framing spacing does not exceed 12" o.c. for 1/2" thick or 16" o.c. for 5/8" thick gypsum board. Water resistant gypsum wallboard shall not be installed over a vapor retarder, or on ceilings in a shower or tub compartment. All cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

*Limitations:* Water-resistant gypsum backing board shall not be used where there will be direct exposure to water, or in areas subject to high humidity. Screws for attaching gypsum board to wood framing shall be type W or Type S in accordance with ASTM C 1002 and shall penetrate the wood not less than 5/8". *Footnote e, Table R702.3.5:* Type X gypsum wallboard for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at 6" o.c. by minimum 1-7/8" 6d coated nails or equivalent drywall screws.

- 3/8" minimum from edge and ends for nails or screws.
- Fastening (nails): 7" o.c. max. ceiling, 8" walls.
- Fastening (screws): 12" o.c. ceiling, 16" o.c. walls when wall framing is 16" o.c., 12" when wall framing is 24" o.c.

84. **STORY/STORY ABOVE GRADE:** IRC Section R202. That portion of a building included between the upper surface of a floor and the upper surface of the floor or

roof next above. A story above grade is any story having its finished floor surface entirely above grade, except that a basement shall be considered as a story above grade where the finished surface of the floor above the basement is: 1) More than 6' above grade plane. 2) More than 6' above the finished ground level for more than 50% of the total building perimeter. 3) More than 12' above the finished ground at any level.

85. **HEIGHT OF BUILDING/GRADE PLANE:** IRC Section R202. The vertical distance from grade plane to the average height of the highest roof surface. The grade plane : A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6' from the building between the structure and a point 6' from the building. Note: Zoning regulations may limit the height of residential structures. Check with the City of Aberdeen Planning Dept. for information concerning height limitations.
86. **RETAINING WALLS:** IRC Section R105.2, R404.5. Retaining walls that are not laterally supported at the top and that retain in excess of 24-inches of unbalanced backfill shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning. Retaining walls that are not over 4' in height measured from the bottom of the footing to the top of the wall not supporting a surcharge is exempt from permits.

## ENERGY CODE

87. **FOUNDATION INSULATION:** WSEC Section 502.1.4.8 & Chapter 6. Slab-on-grade insulation, installed inside the foundation wall, shall extend downward from the top of the slab for a minimum distance of 24" or downward and then horizontally beneath the slab for a minimum combined distance of 24". Insulation installed outside the foundation shall extend downward to a minimum of 24" or to the frostline. Above grade insulation shall be protected. For monolithic slabs, the insulation shall extend downward from the top of the slab to the bottom of the footing. Unless approved for other than prescriptive approach the typical R-Value for slab insulation shall be R-10. Insulation used for this application shall be rated for such use.

88. **UNDER-FLOOR INSULATION:** WSEC Section 502.1.4.7 & Chapter 6. Floor insulation shall be

installed in a permanent manner in substantial contact with the surface being insulated and shall include areas over unconditioned spaces, such as vented crawl spaces, unheated basements and garages. The nominal R-value shall not be less than that approved for floors over unconditioned spaces on the approved building plan. Unless approved for other than prescriptive approach the typical R-Value for floors shall be R-30. See Chapter 6 Table 6-1. Insulation supports shall be installed so spacing is no more than 24" o.c.. Foundation vents shall be placed so that the top of the vent is below the lower surface of the floor insulation.

89. **WALL INSULATION:** WSEC Section 502.1.4.6 & Chapter 6. Above grade exterior walls shall be insulated to not less than the nominal R-value specified on the approved building plans. Unless approved for other than prescriptive approach the typical R-Value for wall

insulation shall be R-21. See Chapter 6, Table 6-1. All exterior wall insulation shall fill the entire framed cavity. Faced batts shall be face-stapled to avoid (*not inset-stapled*), to avoid compression.

90. **ATTIC INSULATION:** WSEC Section 502.1.4.1, 502.1.4.5 & Chapter 6, IBC 1203.2. Ceilings below vented attics shall be insulated to not less than the nominal R- value specified on the approved building plans. Unless approved for other than prescriptive approach the typical R-Value for attic insulation shall be R-38. See Chapter 6 Table 6-1. The thickness of roof/ceiling insulation that is blown in shall be identified by inches of thickness, density and R-Value markers shall be installed at least one for every 300 sq. ft. through the attic/ceiling. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness and the minimum settle thickness with number at least 1" in height. Each marker shall face the attic access. Loose-fill insulation may be used in attic spaces where the slope of the ceiling is not more than 3' in 12 and there is at least 30" attic space. Eave vents shall be provided with baffle to deflect incoming air above the surface of the insulation. The baffles shall be rigid material, resistant to wind driven moisture. The minimum ventilation requirements in IBC Section 1203.2 shall be maintained. Baffles shall be installed so that 1" is maintained between the roof sheathing and the baffle. The baffles shall be installed from the top of the outside wall, extending inward, to a point 6" vertically above the height of non-compressed insulation, and 12" vertically above loose fill insulation.
91. **VAULTED CEILING INSULATION:** WSEC Chapter 2, Section 602.1, & Prescriptive Table 6-1. Vaulted ceiling insulation shall be installed where an enclosed joist or rafter space is formed by ceilings applied directly to the underside of roof joists or rafters. This requirement applies where both the distance between the top of the ceiling and the underside of the roof sheathing is less than 12-inches and there is a minimum 1-inch vented air space above the insulation. Where a single rafter or joist-vaulted ceiling is 13-inches or more the space shall be insulated as a ceiling, typically R-38, described in item #90 of this checklist. Vaulted ceilings shall be insulated to not less than the nominal R-value specified on the approved building plans. Unless approved for other than prescriptive approach the typical R-Value for vaulted ceiling insulation shall be R-30, limited to 500-sq. ft. of any ceiling area for any one dwelling unit. After 500-sq. ft. insulation in a single rafter or joist vaulted ceiling shall be insulated to at least R-38. See Chapter 6 Table 6-1. WSEC Section 502.1.6.3. Faced batts shall be face-stapled (*not inset-stapled*).
92. **ACCESS HATCHES AND DOORS:** WSEC Section 502.1.4.4. Access doors from conditioned to unconditioned spaces (attics and crawl spaces) shall be weather-stripped and insulated to a level equivalent to the insulation on the surrounding surfaces. A wood framed or equivalent baffle or retainer must be provided when loose fill insulation is installed the purpose of which is to prevent insulation from spilling into the living space when the attic access opened and/or to provide a permanent means of maintaining the installed R-value of loose-fill insulation.
93. **DUCT INSULATION/DUCT LEAKAGE:** WSEC Sections 503.9, 503.10 & Table 5-11. Approved R-8 insulation shall be installed in the following locations: ducts, plenums and enclosures located on the roof or exterior of the building or installed in an attic, garage, crawl space, and walls and floor/ceiling spaces. Ducts located in a cement slab or in ground shall be insulated with an approved R-5 insulation. All low-pressure supply and return duct transverse joints, and enclosed stud bays or joist cavities/space used to transport air, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), or mastic embedded-fabric systems installed in accordance with the manufacturer's installation instructions. *Exception:* 1) Ducts or building cavities used for air distribution that are located entirely within the conditioned space do not require sealing. 2) UL 181A listed tapes used with listed rigid fibrous glass ducts may be used as a primary sealant, when installed in accordance with the listing. 3) UL 181B listed tapes used with listed flexible air ducts may be used as a primary sealant, when installed in accordance with the listing. 4) Where enclosed stud bays or joist cavities/spaces are used to transport air sealing may be accomplished using drywall, drywall tape plus joint compound. 5) Tapes installed in accordance with the manufacturer's installation instructions, providing detailed information specific to application on ducts, including approved duct materials and required duct surface cleaning.
94. **PIPE INSULATION:** WSEC Section 503.11 & Table 5-12, UPC (WAC) 313.6. All piping, except piping installed within unitary HVAC equipment, shall be thermally insulated in accordance with Table 5-12. All hot and cold water pipes installed outside the conditioned space shall be insulated to a minimum of R-3.
95. **VAPOR RETARDER/MOISTURE CONTROL:** WSEC Section 502.1.6. Vapor retarders shall be installed on the warm side (*in winter*) of insulation. Vapor retarders shall not be required in roof/ceiling assemblies where the ventilation space above the insulation averages 12" or greater. Faced batts shall be face stapled.
96. **GROUND COVER IN CRAWL SPACE:** WSEC Section 502.1.6.7. A ground cover of 6 mil black polyethylene or approved equal shall be laid over the ground within crawl spaces. The ground cover shall be overlapped 12" minimum at the joints and shall extend to the foundation wall. The ground cover may be

omitted in crawl spaces if the crawl space has a concrete slab with a minimum thickness of 3-1/2".

swimming pool, spa, and other rooms where excess water vapor or cooking odor is produced as follows:

97. **WINDOWS & EXTERIOR DOORS:** WSEC Section 502.1.5 & Tables 6-1, 602.6, 602.7.2. U-Factors for glazing and doors shall be not more than the U-factor specified on the approved building plans. Unless approved for other than prescriptive approach the maximum typical U-factor for glazing shall be .35 and exterior doors shall have a U-factor of .20 or less. See Chapter 6 Table 6-1. Any change in windows or doors must be approved by the Building Department before installation. NFRC compliance stickers shall remain on the windows until the insulation inspection has been approved by the Building Department. Doors with a glazed area more than 50%, such as half-lite and full-lite doors, shall be considered windows for the purposes of energy code requirements. One unlabeled or untested exterior swinging door with a maximum area of 24-sq. ft. may be installed. Single glazing for ornamental, security, or architectural purposes and double glazed garden windows with a wood or vinyl frame shall be exempt from the U-factor calculations provided the total of all single glazing and garden windows does not exceed 1% of the floor area.

98. **AIR LEAKAGE INCLUDING RECESSED LIGHTING FIXTURES:** WSEC 502.4. Provisions to limit air leakage shall be provided to those locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cold. *Seals & Weatherstripping:* a) Exterior joints around windows and door frames, openings between walls and foundation, between walls and roof and wall panels; openings at penetrations of utility services through walls, floors, and roofs; and at all other openings in the building envelope, and between dwelling units shall be sealed, caulked, gasketed or weatherstripped to limit air leakage. Other exterior joints and seams and seams shall be similarly treated or taped, or covered with moisture vapor permeable housewrap. b) All exterior doors or doors serving as access to an enclosed unheated area shall be weatherstripped to limit air leakage around the perimeter when in a closed position. c) Site built windows are exempt from testing but shall be made tight fitting. Fixed lites shall have glass retained by stops with sealant or caulking all around. *Recessed lighting fixtures* shall be type IC rated, and ins and certified under ASTM283 to have no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 pascals or 1.57 lbs/sq. ft. pressure difference and have a label attached, showing with this test method. Recessed lighting fixtures shall be installed with a gasket or caulk between the fixture and ceiling to prevent air leakage.

99. **EXHAUST FANS:** WSVIAQ Section 302, Table 3-1: Source specific exhaust ventilation is required in each kitchen, bathroom, water closet, laundry room, indoor

**MINIMUM SOURCE SPECIFIC VENTILATION  
CAPACITY REQUIREMENTS  
TABLE 3-1**

	LAUNDRY OR BATHROOMS	KITCHENS
Intermittently Operating <input type="checkbox"/>	50 cfm <input type="checkbox"/>	100 cfm <input type="checkbox"/>
Continuous <input type="checkbox"/> Operation <input type="checkbox"/>	20 cfm <input type="checkbox"/>	25 cfm <input type="checkbox"/>

**NOTE:** All fans shall provide the required flow when tested at .25 water gauge. Ventilation ducts shall terminate outside the building. Ventilation ducts located in unconditioned spaces shall be insulated to a minimum of R-4.

100. **WHOLE HOUSE VENTILATION SYSTEMS:** WSVIAQ Section 302.3, . Each dwelling unit shall be equipped with a whole house ventilation system that shall be capable of providing the volume of outdoor air specified in Table 3-2 under normal operating conditions. Intermittently operated whole house ventilation systems shall be constructed to have the capability for continuous operation, and shall have a manual control, such as a 24-hour clock timer. At the time of final inspection, the automatic control timer shall be set to operate the whole house fan for at least 8 hours a day. The clock timer shall be readily accessible and be capable of operating the whole house ventilation fan without energizing other energy consuming appliances. A label shall be affixed to the controls that reads "Whole House Ventilation (see operating instructions)." The cfm rating for the whole house fan shall be measured using the flow rating at 0.25" water gauge. Whole house fans located 4 feet or less from the interior grille shall have a sone rating of 1.5 or less measured at 0.10" water gauge. Manufacturer's noise ratings shall be determined as per HVI 915 (October 1995).

**WHOLE HOUSE EXHAUST FAN  
PRESCRIPTIVE REQUIREMENTS  
Table 3-2**

Floor Area, sq. ft	Bedrooms							
	2 or less		3		4		5	
	Min	max	min	max	min	max	min	max
<500	50	75	65	98	80	120	95	143
501-1000	55	83	70	105	85	128	100	150
1001-1500	60	90	75	113	90	135	105	158
1501-2000	65	98	80	120	95	143	110	165
2001-2500	70	105	85	128	100	150	115	173

2501-3000	75	113	90	135	105	158	120	180
3001-3500	80	120	95	143	110	165	125	188

101. **VENTILATION DUCTS:** WSVIAQ Section 302.2.3 & 302.3.4, 303.4.1.4, 303.4.2.3, 303.4.3.2, 303.4.3.5, 303.4.4.3. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4. All supply ducts located in the conditioned space shall be insulated to R-4. All ducts shall terminate outside the building. Fan ducts shall be equipped with back draft dampers. Terminal elements shall have at least the equivalent net free area of the ductwork. Terminal elements for exhaust fan duct systems shall be screened or otherwise protected from entry by leaves or other material.

102. **OUTDOOR AIR SUPPLY:** WSVIAQ 302.3.5.3. Outdoor air shall be distributed to each habitable room by means such as individual inlets, separate duct systems, or a forced air system. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms or other similar means. Doors shall be undercut to a minimum ½" above of the surface of the finish floor. A mechanical system shall supply outdoor air as required in WSVIAQ Section 302.3.1. The mechanical system may consist of exhaust fans, supply fans, or both.

103. **OUTDOOR AIR INLETS:** WSVIAQ 302.3.5, 303.4.1.5. Individual room outdoor air inlets shall have a) controllable and secure opening. b) be sleeved or otherwise designed so as not to compromise the thermal properties of the wall or window in which they are placed. c) Provide not less than 4 sq. inches of net free area of opening for each habitable space. Any inlet or combination of inlets which provide 10 cfm at 10 Pascals as determined by the Home Ventilating Institute Air Flow Test Standard (HVI 901 11/96) are deemed equivalent to 4 sq. in. net free area. Where outdoor air supplies (*window or wall ports*) are separated from fan locations by doors, adequate airflow shall be ensured by undercutting doors or installing grilles or transoms. Doors and operable lites in windows are not deemed to meet the outdoor air supply intake requirements. Outdoor inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor inlets shall be located so as not to take air from the following areas: a) Closer than 10' from an appliance vent outlet, unless such vent outlet is 3' above the outdoor air inlet. b) Where it will pick-up objectionable odors, fumes or other flammable vapors. c) A hazardous or unsanitary location. d) A room or space having and fuel-burning appliances therein. e) closer than 10' from any vent opening of a plumbing drainage system unless the vent is located at least 3' above the air inlet. f) Attic, crawl spaces, or garages. *Exception:* Exhaust only ventilation systems do not require outdoor inlets if the home has a ducted forced air heating system that communicated with all habitable rooms and the interior doors are undercut to

a minimum ½" above the surface of the walking surface of the finish floor covering.

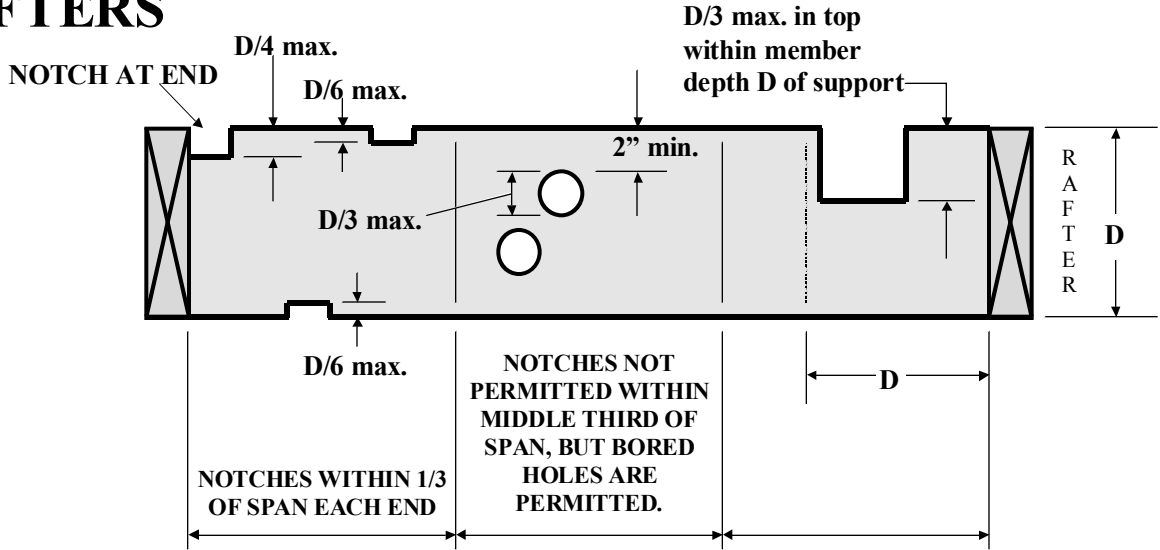
104. **MAKE-UP AIR THROUGH FURNACE:** WSVIAQ Section 302.3.5.6, 303.4.2 & Table 3-5. The outdoor air connection to the return air stream shall be located upstream of the forced-air system blower and shall not be connected directly into a furnace cabinet. The outdoor air duct shall be sized in accordance with WSVIAQ table 3-5 and shall be equipped with dampers as specified in WSVIAQ 303.4.2.1.

105. **LIGHTING:** WSEC Section 505 & Chapter 2. Luminaires providing outdoor lighting and permanently mounted to a residential building or to other buildings on the same lot shall be high efficacy luminaires. High efficiency luminaires as defined in Chapter 2 of the WSEC includes a lighting fixture that does not contain a medium screw base socket and whose lamps have a minimum efficiency of: a) 60 lumens per watt for lamps over 40 watts; b) 50 lumens per watt for lamps over 15 watts to 40 watts; c) 40 lumens per watt for lamps 15 watts or less. *Exception: 1) Permanently installed outdoor luminaires that are not high efficacy shall be allowed provided they are controlled by a motion sensor(s) with integral photocontrol photosensor. 2) Permanently installed luminaires in or around swimming pools or water features.* All linear fluorescent fixtures must be fitted with T-8 (1-inch diameter) or smaller lamps (but not T-10 or T-12 lamps). This applies to all typical fluorescent fixtures used for interior or exterior lighting.

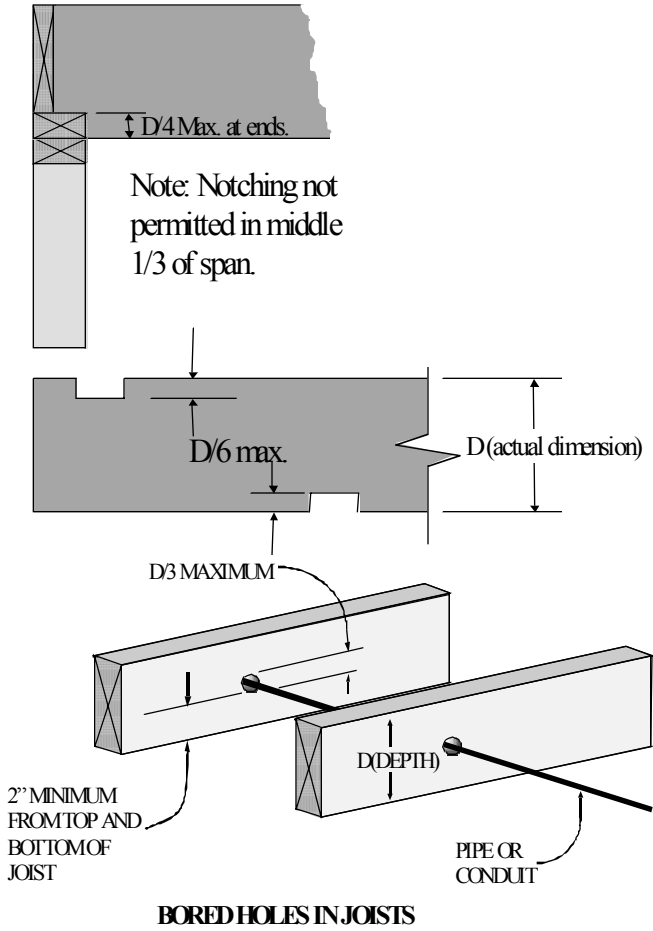


# Cutting, Notching and Boring of Joists, Rafters, and Studs

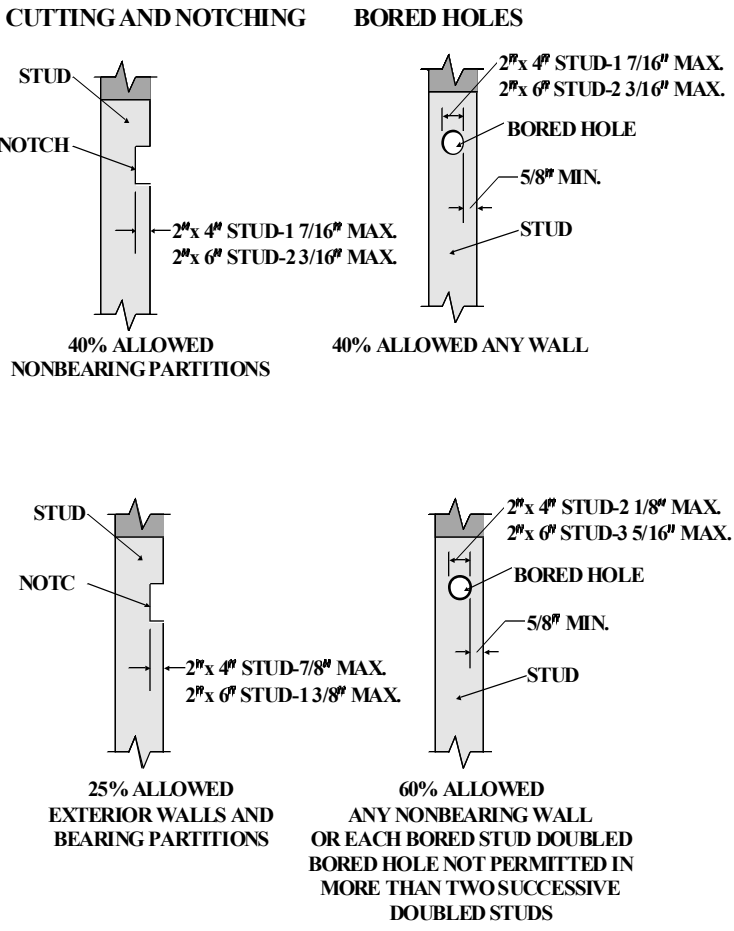
## RAFTERS



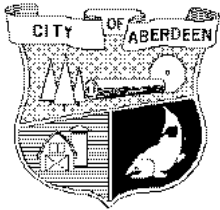
## FLOOR JOISTS



## WALL STUDS



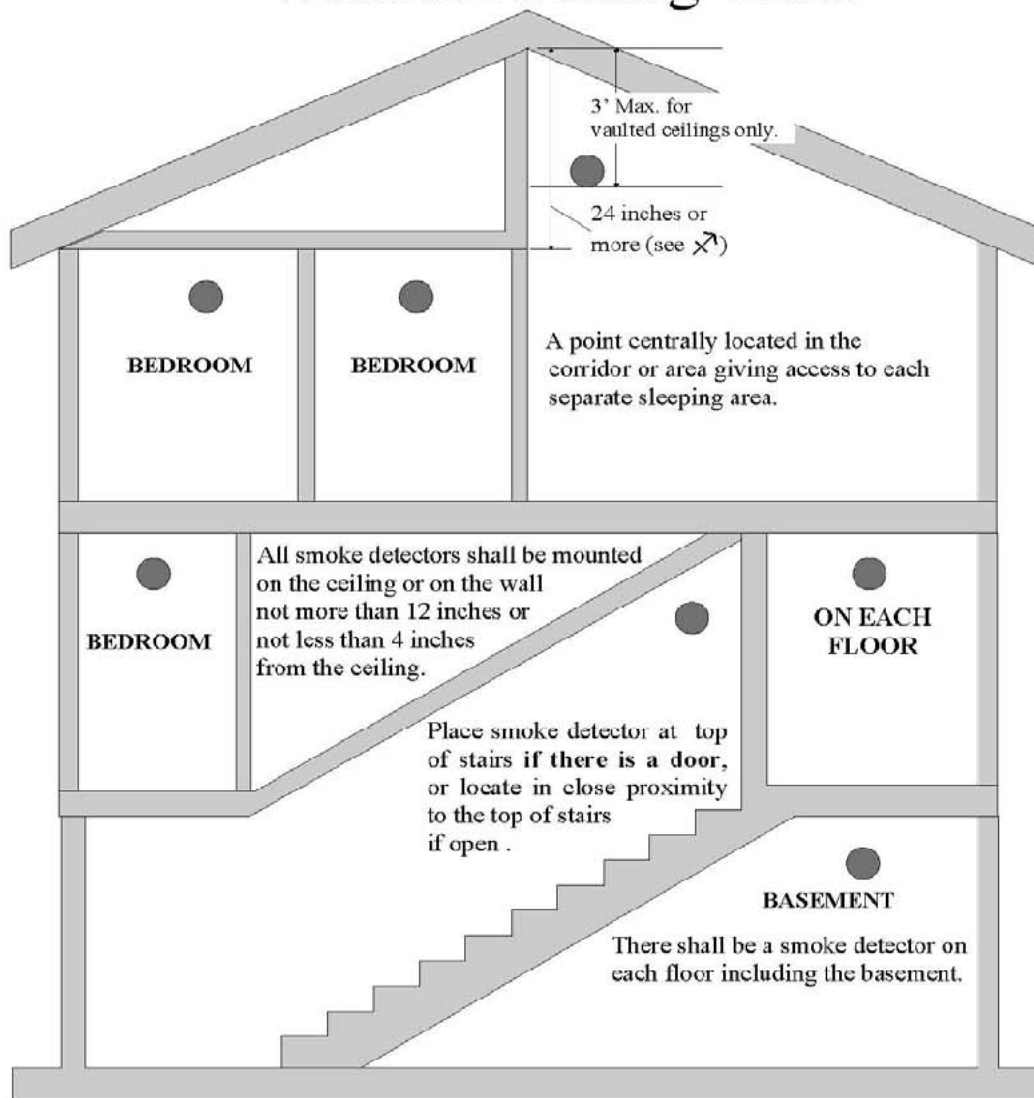




## CITY OF ABERDEEN BUILDING DEPARTMENT

BOB WAITE (537-3214)  
RAY OLSON (537- 3250) MATT ANGLESEY (537- 3221)  
200 EAST MARKET STREET, ABERDEEN, WA 98520-5207  
FAX (360) 537-3350

# LOCATION OF SMOKE DETECTORS Within Dwelling Units



❄ Where the ceiling height of a **room** open to the hallway serving the bedrooms exceeds that of the hallway by **24 inches or more**, smoke detectors shall be installed in the hallway and in the adjacent room. If ceiling is vaulted or sloped detector shall be within 3' on a horizontal plane of the highest part of ceiling. Detectors shall be installed in accordance with the approved manufacturer's instructions.

As per Manufacture's instructions smoke detectors shall not be located within 10 feet of a bathroom door. (A photoelectric detector can be used if less than 10 feet)

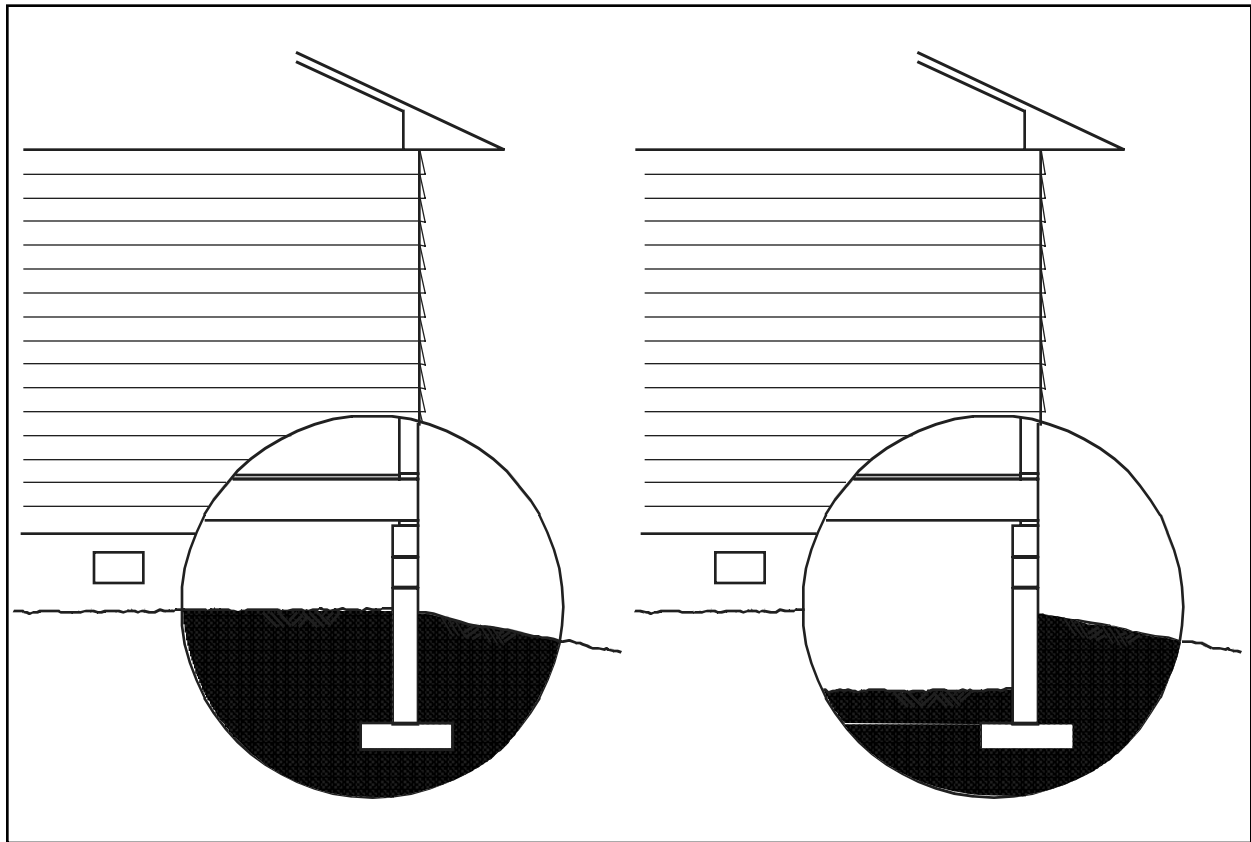


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## Crawlspace Construction for Buildings Located in Special Flood Hazard Areas

National Flood Insurance Program Interim Guidance

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FEDERAL EMERGENCY MANAGEMENT AGENCY  
FEDERAL INSURANCE AND MITIGATION ADMINISTRATION

FIA-TB-11  
(11/01)

## Key Word/Subject Index

This index allows the user to locate key words and subjects in this Technical Bulletin. The Technical Bulletin User's Guide (printed separately) provides references to key words and subjects throughout the Technical Bulletins. For definitions of selected terms, refer to the Glossary at the end of this bulletin.

Key Word/Subject Index	Page
Best practices for crawlspace foundations in the SFHA	6
Drainage considerations	8
NFIP requirements for all crawlspace construction	3
Flood forces on buildings	5
Flood insurance implications	6
Flood-resistant materials	8
Pre-engineered below-grade crawlspace foundation guidance	7
Requirements, additional for below-grade crawlspaces	4
Utilities, access, and ventilation openings	9

Any comments on the Technical Bulletins should be directed to:

Federal Emergency Management Agency  
Federal Insurance and Mitigation Administration  
500 C Street, SW.  
Washington, DC 20472

## TECHNICAL BULLETIN 11-01

### **Crawlspace Construction for Buildings Located in Special Flood Hazard Areas National Flood Insurance Program Interim Guidance**

#### **Introduction**

Crawlspace foundations are commonly used to elevate the lowest floors of residential buildings located in Special Flood Hazard Areas (SFHAs) above the Base Flood Elevation (BFE). This Technical Bulletin provides guidance on crawlspace construction and supports a recent policy decision to allow construction of crawlspaces with interior grades up to 2 feet below the lowest adjacent exterior grade (LAG), referred to as below-grade crawlspaces, provided that other requirements are met. Prior to that decision, below-grade crawlspaces were considered basements under the National Flood Insurance Program (NFIP) Floodplain Management Regulation definitions at 44 CFR 59.1 and were not permitted below the BFE. This requirement had been established because below-grade crawlspace foundation walls are exposed to increased forces during flood conditions, such as hydrostatic and saturated soil forces.

In many parts of the country, a common practice is to construct crawlspaces with the interior floor 1 or 2 feet below-grade by either (1) backfilling against the exterior of the foundation wall or (2) excavating the crawlspace area to construct footings that result in a below-grade crawlspace floor. Because FEMA wishes to recognize common construction practices that do not increase flood damage, FEMA recently completed a review of the policy for residential crawlspace construction. In this review, the construction practices for below-grade crawlspaces were examined to determine whether a crawlspace that was 1 or 2 feet below grade would increase the flood damage potential to the foundation walls or result in additional damages to the building.

The review included (1) an engineering analysis that assessed the damage potential of floodwaters acting upon below-grade crawlspace foundation walls, (2) a review of available NFIP claims history for crawlspaces, and (3) input from FEMA Regional staff and NFIP General Adjusters of any firsthand knowledge of crawlspace damage during flood events. A review of NFIP claims history and staff input did not reveal evidence of structural damage or failure of crawlspace foundation walls during flood events. The engineering analysis indicates that below-grade foundation walls, when constructed according to common practice, have sufficient capacity to resist flood-related forces from standing and low-velocity floodwaters, subject to the requirements outlined in this bulletin.

This Technical Bulletin presents NFIP minimum requirements for crawlspace construction in the SFHA, including (1) requirements for all crawlspace construction and (2) requirements for below-grade crawlspace construction that may extend 1 or 2 feet below grade in the SFHA. This Technical Bulletin also provides a best practices approach for preferred and below-grade crawlspace construction, illustrated in Figures 1 and 2, including design limitations, water accumulation and drainage considerations, and use of flood-resistant materials. While communities may now allow below-grade crawlspace construction in the SFHA, this type of construction is not the recommended construction method, because of the increased likelihood of problems with water accumulation,

moisture damage, and drainage. The use of crawlspace construction with the interior grade at or above the LAG minimizes the occurrence of these problems. This interim guidance on residential crawlspace construction is based on conclusions from the recently completed review and analyses.

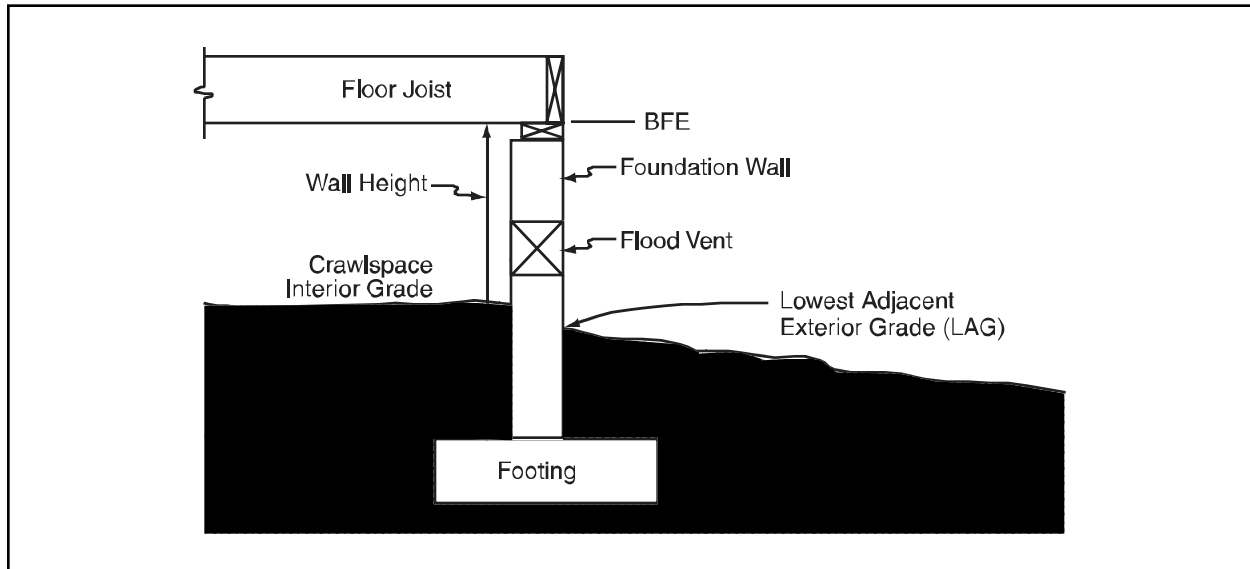


Figure 1 Preferred crawlspace construction.

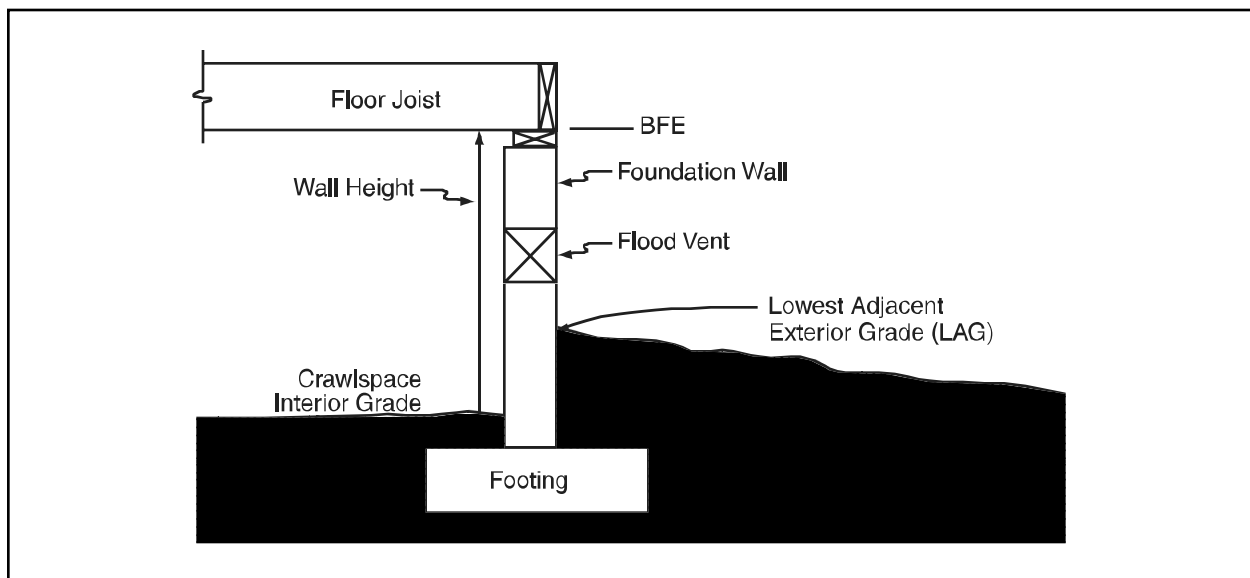


Figure 2 Below-grade crawlspace construction.



This Technical Bulletin provides **interim** guidance. The decision whether or not to allow below-grade crawlspace construction will be left to each community. Communities should review applicable state laws, regulations, and building codes, and consult with their State NFIP Coordinator to determine whether below-grade crawlspace construction is permitted in their state. Communities that choose to allow below-grade crawlspace construction will be required to amend their floodplain management ordinance to include the provisions outlined in the following sections on below-grade crawlspace construction. Please note that communities that choose to amend their ordinance to allow for below-grade crawlspaces in response to this interim guidance may also be required at some later date to amend their ordinance if FEMA adopts revised regulations that differ from the interim guidance.

#### **Note**

Any building utility systems within the crawlspace must be elevated above the BFE or designed so that floodwaters cannot enter or accumulate within system components during flood conditions. Ductwork, in particular, must either be placed above the BFE or sealed to prevent the entry of floodwaters. FEMA 348, *Protecting Building Utilities from Flood Damage*, provides detailed guidance on designing and constructing flood-resistant utility systems.

## **NFIP Requirements**

NFIP requirements that apply to crawlspace construction are found in sections 44 CFR 60.3(a)(3) and 60.3(c)(2) and (c)(5) of the NFIP regulations. NFIP requirements that apply to all crawlspaces are discussed in the first section below. The second section lists additional requirements that must be applied to crawlspaces that have interior grades below the LAG. The additional requirements are intended to ensure that these crawlspaces are not subject to flood-related loads that would exceed the strength of the crawlspace wall and lead to failure and significant damage to the building or to other damage related to poor drainage in the below-grade crawlspace.

### **NFIP Requirements for All Crawlspace Construction**

Crawlspaces are commonly used as a method of elevating buildings in SFHAs to or above the BFE. General NFIP requirements that apply to all crawlspaces that have enclosed areas or floors below the BFE include the following:

- The building must be designed and adequately anchored to resist flotation, collapse, and lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Hydrostatic loads and the effects of buoyancy can usually be addressed through the required openings discussed in the next bullet. Because of hydrodynamic loads, crawlspace construction is not recommended in areas with flood velocities greater than 5 feet per second unless the design is reviewed by a qualified design professional, such as a registered architect or professional engineer. Other types of foundations are recommended for these areas.
- The crawlspace is an enclosed area below the BFE and, as such, must have openings that equalize hydrostatic pressures by allowing for the automatic entry and exit of floodwaters. The bottom of each flood vent opening can be no more than 1 foot above the lowest adjacent exterior grade. For guidance on flood openings, see Technical Bulletin 1-93, *Openings in Foundation Walls*.

- Crawlspace construction is not permitted in V zones. Open pile or column foundations that withstand storm surge and wave forces are required in V zones.
- Portions of the building below the BFE must be constructed with materials resistant to flood damage. This includes not only the foundation walls of the crawlspace used to elevate the building, but also any joists, insulation, or other materials that extend below the BFE. The recommended construction practice is to elevate the bottom of joists and all insulation above BFE. Insulation is not a flood-resistant material. When insulation becomes saturated with floodwater, the additional weight often pulls it away from the joists and flooring. Ductwork or other utility systems located below the insulation may also pull away from their supports. See the section Flood-Resistant Materials, on page 8 this bulletin. For more detailed guidance on flood-resistant materials see Technical Bulletin 2-93, *Flood-Resistant Materials Requirements*.
- Any building utility systems within the crawlspace must be elevated above BFE or designed so that floodwaters cannot enter or accumulate within the system components during flood conditions. Ductwork, in particular, must either be placed above the BFE or sealed from floodwaters. For further guidance on the placement of building utility systems in crawlspaces, see FEMA 348, *Protecting Building Utilities From Flood Damage*.

Flood-resistant materials and utilities, access, and ventilation openings in crawlspaces are further addressed in this bulletin.

### **Additional Requirements for Below-Grade Crawlspaces**

If a community chooses to amend its floodplain management ordinance to allow for the construction of below-grade crawlspaces, the ordinance must include the following provisions in addition to the above requirements:

- The interior grade of a crawlspace below the BFE must not be more than 2 feet below the lowest adjacent exterior grade (LAG), shown as D in Figure 3.
- The height of the below-grade crawlspace, measured from the interior grade of the crawlspace to the top of the crawlspace foundation wall must not exceed 4 feet (shown as L in Figure 3) at any point. The height limitation is the maximum allowable unsupported wall height according to the engineering analyses and building code requirements for flood hazard areas (see the section Guidance for Pre-Engineered Crawlspaces, on page 7 of this bulletin). This limitation will also prevent these crawlspaces from being converted into habitable spaces.
- There must be an adequate drainage system that removes floodwaters from the interior area of the crawlspace. The enclosed area should be drained within a reasonable time after a flood event. The type of drainage system will vary because of the site gradient and other drainage characteristics, such as soil types. Possible options include natural drainage through porous, well-drained soils and drainage systems such as perforated pipes, drainage tiles, or gravel or crushed stone drainage by gravity or mechanical means.
- The velocity of floodwaters at the site should not exceed 5 feet per second for any crawlspace. For velocities in excess of 5 feet per second, other foundation types should be used.

- Below-grade crawlspace construction in accordance with the requirements listed above will not be considered basements.

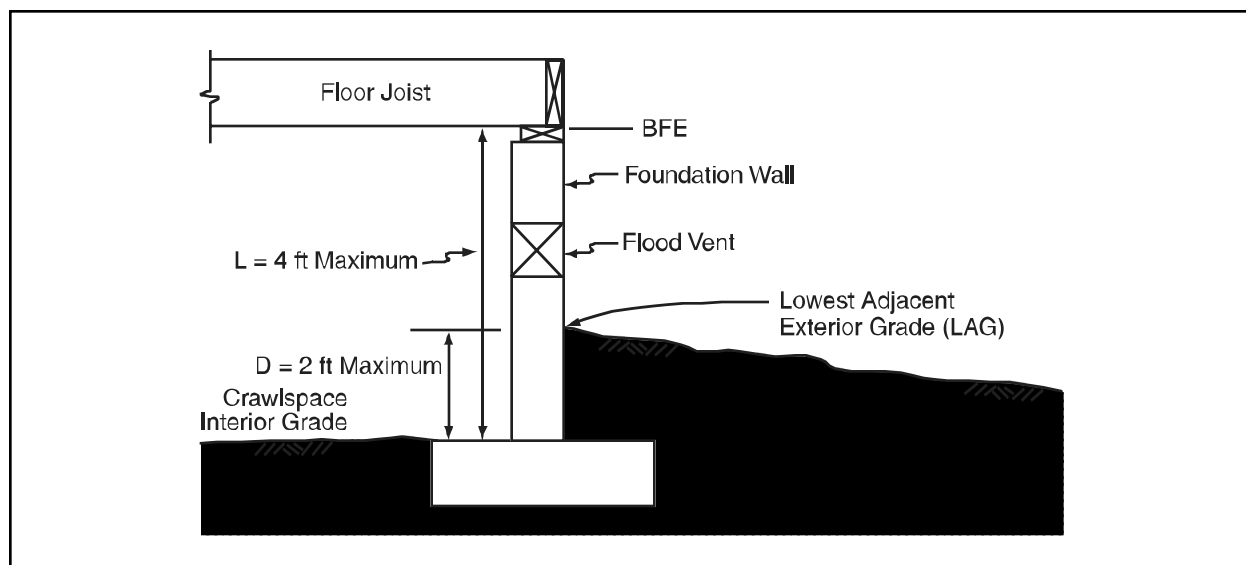


Figure 3 Requirements regarding below-grade crawlspace construction.

Drainage considerations for below-grade crawlspaces are further addressed in this bulletin. For additional information regarding this interim guidance, please contact the FEMA Regional Office or State NFIP Coordinator. Local FEMA regional offices are listed in the separately printed *User's Guide to Technical Bulletins* and may be found at the [www.fema.gov](http://www.fema.gov) website.

## Flood Forces on Buildings

Buildings in flood hazard areas may be subjected to a variety of flood-induced forces. During inundation by standing or low-velocity floodwaters, a building must primarily resist hydrostatic pressures from saturated soils and floodwaters. This situation is typical of broad, flat floodplains and floodways along lower-gradient rivers and streams. During inundation by high-velocity floodwaters, a building must also resist hydrodynamic forces and impact loads. High-velocity floodwaters are found in floodways along steeper-gradient rivers, sheet flow down slopes, or coastal areas with storm surge and waves.

The community Flood Insurance Study contains a Floodway Data Table that includes data on mean velocities (in feet per second) within the floodway at each cross section along the river or stream. The mean averages the higher channel velocities with lower velocities in overbank areas that are within the floodway. Generally, velocities at sites outside of the floodway are lower than the mean floodway velocities listed in the Floodway Data Table. For example, if the mean floodway velocity at a cross section is 4 feet per second, the velocities outside the floodway are likely less than that value. If in doubt about the floodway velocity or in areas where the mean floodway velocity may exceed 5 feet per second, contact an engineer knowledgeable in hydraulics and hydrology to determine flood velocities at the building site.

Buildings located in areas subject to ponding or low-velocity flows must primarily address issues related to hydrostatic loads on the crawlspace foundation, removal of floodwater and sediment from the crawlspace area, and other NFIP floodproofing requirements, such as protecting or elevating utilities and using flood-resistant materials.

Crawlspace construction is not recommended in A zones with high-velocity floodwaters (greater than 5 feet per second). Other types of foundations, such as open pile or column foundations, that allow floodwaters to flow freely beneath the building are recommended for these areas.

## **Flood Insurance Implications**

In May 1999, the Federal Insurance Administration (now the Federal Insurance and Mitigation Administration – FIMA) revised the rates being charged for residential buildings with below-grade crawlspaces. These rates were considerably lower than the full basement rates previously charged for these buildings. In May 2001, these rates were further reduced based on engineering analyses performed by FEMA. However, rates for buildings with below-grade crawlspaces will be higher than rates for buildings that have the interior grade of the crawlspace at or above the adjacent exterior grade, since the risk of flood damage is greater for the former type of construction. As more experience is gained on crawlspace losses, FEMA will continue to reassess those rates, factoring in the cost of pumping out and cleaning these areas, as well as physical damage to the foundation. Buildings with below-grade crawlspaces currently cannot be rated by an insurance agent using the NFIP *Flood Insurance Manual*. They must be submitted for a special rating under the Submit-to-Rate process by underwriters knowledgeable in this type of construction. FIMA will determine whether the rating for this type of construction should be standardized and included in the Flood Insurance Application and the *Flood Insurance Manual*.

### **Caution**

Buildings that have below-grade crawlspaces will have higher flood insurance premiums than buildings that have the preferred crawlspace construction, with the interior elevation at or above the lowest adjacent exterior grade (LAG).

## **Best Practices for Crawlspace Foundations in SFHA**

The NFIP preferred construction practice for excavated crawlspace construction is to backfill the interior area so that it is level with or higher than the LAG. If trench construction is used to place footings, the trenches should be backfilled to the level of the adjacent exterior grade, to avoid ponding of water. A reinforced masonry or concrete foundation wall that is anchored to the footing and lowest floor with connectors will provide the best performance in flood events. This type of construction will better resist hydrostatic pressures against the foundation and limit the amount of water that will pond under the building after a flood.

The 2000 *International Residential Code* (IRC 2000), Section 327, addresses flood-resistant design and construction of foundation walls in flood hazard areas and is consistent with NFIP requirements. The IRC requires that all structural systems in floodplains be designed, connected, and anchored to resist flotation, collapse, or permanent lateral movement due to structural loads from flooding equal to the design flood elevation. The IRC limits the unsupported height of plain (unreinforced) 8-inch hollow masonry walls to 4 feet for flood-resistant construction, where the unsupported height is the distance from the finished grade of the enclosed crawlspace area to the top of the foundation wall.

A community that chooses to allow the construction of below-grade crawlspaces should develop a multi-hazard approach that also resists other loads from hazards such as wind and earthquake. Crawlspace foundation walls must bear or resist all loads that may be experienced during their useful service life.

### Guidance for Pre-Engineered Below-Grade Crawlspace Foundations

FEMA performed an engineering analysis to determine the effect of flood-related forces on crawlspace foundation walls (see Figure 4), particularly for unreinforced concrete and concrete masonry construction. The analysis followed design criteria prescribed in the American Concrete Institute (ACI) *Building Code Requirements and Commentary for Reinforced Concrete* (ACI 318-92) and the 1999 Masonry Standards Joint Committee (MSJC) *Building Code Requirements and Specifications*. Flood analysis procedures from FEMA 259, *Engineering Principles and Practices of Retrofitting Flood-Prone Residential Structures*, were used for calculating hydrostatic and hydrodynamic forces. A comprehensive analysis of two flood scenarios was conducted:

- Fully saturated soil and 1-foot-deep floodwaters, that just reach the bottom of the flood opening, but have not flooded the enclosed crawlspace area.
- A fully flooded crawlspace area with velocity floodwaters acting on the above-grade portion of the crawlspace walls.

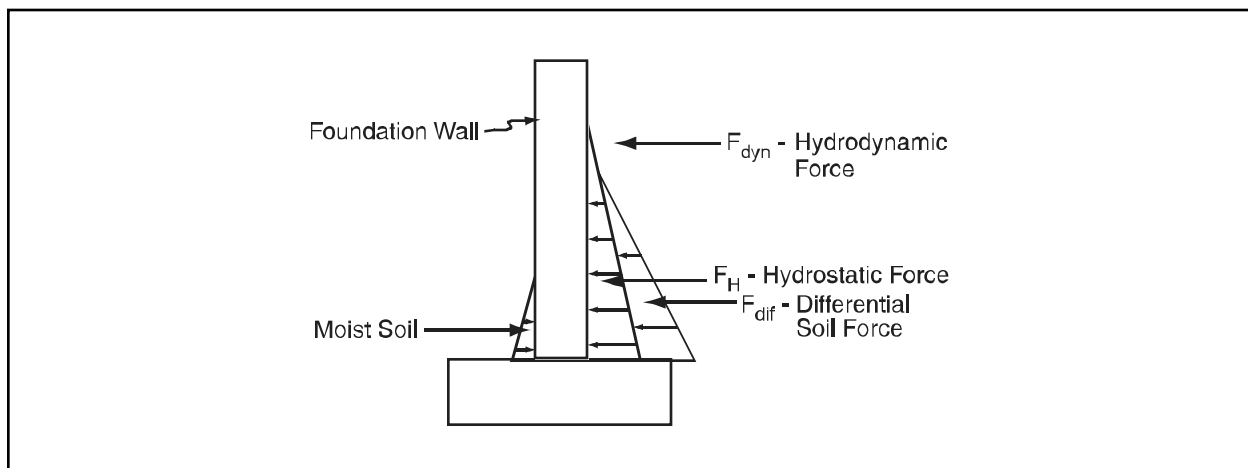


Figure 4 Flood-related forces on a crawlspace wall.

The first analysis evaluated four parameters: (1) wall construction of unreinforced 8-inch and 12-inch masonry block with standard M or S mortar type and 6-inch plain concrete foundation walls, (2) depth of interior crawlspace grade relative to the LAG, (3) flood velocity, and (4) soil types suitable for construction. The hydrostatic pressures from the saturated soil and 1-foot-deep floodwaters cause the maximum loads to occur in the lower section of the wall below the exterior grade. This analysis assumed that the 1-foot-deep floodwaters have a low velocity and are unlikely to cause significant hydrodynamic or impact loads on the foundation wall.

The second analysis evaluated hydrodynamic forces for varied flood depths and flood velocities on a foundation wall. The analysis assumed that the crawlspace was provided with proper openings to equalize hydrostatic pressure. Impact forces were not included in the analysis, as the shallow flood depths and low-velocity flows are not expected to produce significant debris impact damage. This decision was further supported by the lack of field evidence concerning wall failures from impact by debris. However, debris impact should be considered as part of the foundation wall design and analysis for riverine or other locations with high-velocity flows.

These analyses found that a crawlspace can resist flood-related forces for flood velocities up to 5 feet per second, if the wall height is limited to 4 feet and the top of the footing is no more than 2 feet below-grade.

As a result of these analyses, FEMA has determined that communities may allow below-grade residential crawlspace construction provided that the interior grade of the crawlspace does not exceed 2 feet below the LAG, and the height of the crawlspace measured from the interior grade of the crawlspace at any point to the bottom of the lowest horizontal structural member of the lowest floor does not exceed 4 feet for the specified wall construction.

## **Flood-Resistant Materials**

All structural and non-structural building materials at or below the BFE must be flood resistant. A flood-resistant material is defined as any building material capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. Flood-resistant materials must be used for all building elements subject to exposure to floodwaters, including floor joists, insulation, and ductwork. If flood-resistant materials are not used for building elements, those elements must be elevated above the BFE. The term “prolonged contact” means at least 72 hours, and the term “significant damage” means any damage requiring more than low-cost cosmetic repair (such as painting). This requirement applies regardless of the expected or historical flood duration. Technical Bulletin 2-93, *Flood Resistant Materials Requirements*, further defines NFIP criteria for flood-resistant materials and material categories.

## **Drainage Considerations**

A significant issue associated with below-grade crawlspaces is drainage of the interior crawlspace area after normal precipitation and flood events. Moisture damage to a building can be severe when water remains standing in the crawlspace area after precipitation or a flood event. Standing water also creates significant health hazards, such as mosquito breeding grounds and growth of bacteria, mold, and fungus. If crawlspace access doors do not remain secured, standing water also presents a drowning hazard.

The interim guidance for below-grade crawlspace construction requires an adequate drainage system that allows floodwaters to drain from the interior area of the crawlspace within a reasonable time. A maximum time of 72 hours is recommended to minimize floodwater contact with crawlspace materials and related moisture damage. The interim guidance is not prescriptive as to a type of drainage system; however, it is the community's responsibility to ensure that all buildings with below-grade crawlspaces have adequate drainage systems to ensure that accumulated waters drain from the crawlspace area. Communities must include in their ordinances a provision that addresses drainage requirements.

Drainage systems for below-grade crawlspace areas will vary because of site characteristics and soil types. Possible drainage system options include perforated pipes, drainage tiles, or gravel or crushed stone drainage by gravity or mechanical means. Fill dirt placed around the outside of the foundation wall should be adequately graded to slope away from the foundation and aid natural site drainage. If lots are too small to provide adequate site drainage through grading, other methods, such as swales, may be used to provide drainage away from the structure. Foundation drainage practices required by local codes must be met in addition to drainage of the enclosed below-grade crawlspace area.

Any enclosed area below the BFE is subject to flood forces and must have exterior wall openings whose bottom edges are no more than 1-foot above the LAG, in accordance with NFIP regulations. The wall openings allow the automatic entry and exit of floodwaters and for the floodwaters to reach equal levels on both sides of the foundation wall. The only exception to this requirement is dry floodproofed non-residential buildings. Further information on NFIP requirements for flood openings in foundation walls is found in Technical Bulletin 1-93, *Openings in Foundation Walls*.

## **Utilities, Access, and Ventilation Openings**

NFIP regulations at 44 CFR, Section 60.3(a)(3)(iv) require that "utility systems shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located to prevent water from entering or accumulating within the components during conditions of flooding." The utility systems can be either elevated above the BFE or floodproofed in a manner that prevents floodwaters from infiltrating or accumulating within any component of the system. Elevation is the recommended method of mitigation for utility systems in A Zones. FEMA 348, *Protecting Building Utilities from Flood Damage*, provides detailed guidance on designing and constructing flood-resistant utility systems.

Access and ventilation openings shall be provided to the crawlspace area according to the local building codes and regulations. Access and ventilation requirements under the IRC 2000 include the following:

- An access opening 18 inches by 24 inches shall be provided to the enclosed crawlspace area to allow access to mechanical equipment or building utilities located in this space.
- The minimum net area of required ventilation openings shall not be less than 1 square foot for each 150 square feet of enclosed crawlspace area. One such ventilation opening shall be within 3 feet of each corner of the building. Ventilation openings shall be covered with an appropriate material.

## **The NFIP**

The NFIP was created by Congress in 1968 to provide federally backed flood insurance coverage, because flood coverage was generally unavailable from private insurance companies. The NFIP is also intended to reduce future flood losses by identifying floodprone areas and ensuring that new development in these areas is adequately protected from flood damage. The NFIP is based on an agreement between the Federal government and participating communities that have been identified as floodprone. FEMA, through the Federal Insurance and Mitigation Administration, makes flood insurance available to the residents of a participating community, provided the community adopts and enforces adequate floodplain management regulations that meet the minimum NFIP requirements. The NFIP encourages communities to adopt floodplain management ordinances that exceed the minimum NFIP criteria set forth in Part 60 of the NFIP Floodplain Management Regulations (44 CFR 60). Included in the NFIP requirements, found under Title 44 of the U.S. Code of Federal Regulations, are minimum building design and construction standards for buildings located in SFHAs. Through their floodplain management ordinances or laws, communities adopt the NFIP performance standards for new, substantially improved, and substantially damaged buildings in floodprone areas identified on FEMA's Flood Insurance Rate Maps (FIRMs).

## **Technical Bulletins**

This publication is one of a series of Technical Bulletins that FEMA has produced to provide guidance concerning the building performance standards of the NFIP. These standards are contained in 44 CFR 60.3. The bulletins are intended for use primarily by state and local officials responsible for interpreting and enforcing NFIP regulations and by members of the development community, such as design professionals and builders. New bulletins, as well as updates of existing bulletins, are issued periodically, as necessary. The bulletins do not create regulations; rather they provide specific guidance for conforming with the minimum requirements of existing NFIP regulations. Users of the Technical Bulletins who need additional guidance concerning NFIP regulatory requirements should contact the Mitigation Division of the appropriate FEMA Regional Office or the local floodplain administrator. NFIP Technical Bulletin 0, *User's Guide to Technical Bulletins*, lists the bulletins issued to date, provides a key word/subject index for the entire series, and lists addresses and telephone numbers for FEMA's 10 Regional Offices.

## **Ordering Information**

Copies of FEMA Technical Bulletins can be obtained from the FEMA Regional Office that serves your area. In addition, Technical Bulletins and other FEMA publications can be ordered from the FEMA Publications Distribution Facility at 1-800-480-2520. The Technical Bulletins are also available at the FEMA web site at [www.fema.gov](http://www.fema.gov).



## Further Information

The following publications contain information related to the guidance presented in this bulletin:

American Concrete Institute. 1992. ACI318-92. *Building Code Requirements and Commentary for Reinforced Concrete*. Detroit, MI.

American Society of Civil Engineers. 1998. SEI/ASCE 7-98. *Minimum Design Loads for Buildings and Other Structures*. Reston, VA.

American Society of Civil Engineers. 1998. SEI/ASCE 24-98. *Flood Resistant Design and Construction*. Reston, VA.

Federal Emergency Management Agency. 1986. *Floodproofing Non-Residential Structures*. FEMA 102. Washington, DC.

Federal Emergency Management Agency. 1999. *Protecting Building Utility Systems From Flood Damage*. FEMA 348. Washington, DC.

Federal Emergency Management Agency. 2001. *Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures*. FEMA 259. Washington, DC.

International Code Council. 2000. *International Building Code*. Birmingham, AL.

International Code Council. 2000. *International Residential Code*. Birmingham, AL.

Masonry Standards Joint Committee. 1999. ACI 530-99/ASCE 5-99/TMS 402-99. *Building Code Requirements for Masonry Structures*.

National Association of Home Builders Research Foundation, Inc. 1977. *Manual for the Construction of Residential Basements in Non-Coastal Flood Environs*. Upper Marlboro, MD. March.

National Association of Home Builders Research Center, Inc. 2000. *Residential Structural Design Guide: 2000 Edition*. Upper Marlboro, MD.

National Concrete Masonry Association. 2000. TR121. *Concrete Masonry Design Tables*. Herndon, VA.

## Glossary

**Base Flood** – The flood that has a 1-percent probability of being equaled or exceeded in any given year (also referred to as the 100-year flood).

**Basement** – Any area of a building having its floor subgrade (below ground level) on all sides.

**Community** – Any state or area or political subdivision thereof, or any Indian tribe or authorized tribal organization, or Alaska Native village or authorized native organization, which has the authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction.

**Federal Emergency Management Agency (FEMA)** – The independent Federal agency that, in addition to carrying out other activities, administers the NFIP.

**Federal Insurance and Mitigation Administration (FIMA)** – The component of FEMA directly responsible for administering the flood hazard identification, floodplain management, and flood insurance activities of the NFIP.

**Flood Insurance Rate Map (FIRM)** – The insurance and floodplain management map issued by FEMA that identifies, on the basis of detailed or approximate analysis, areas of 100-year flood hazard in a community.

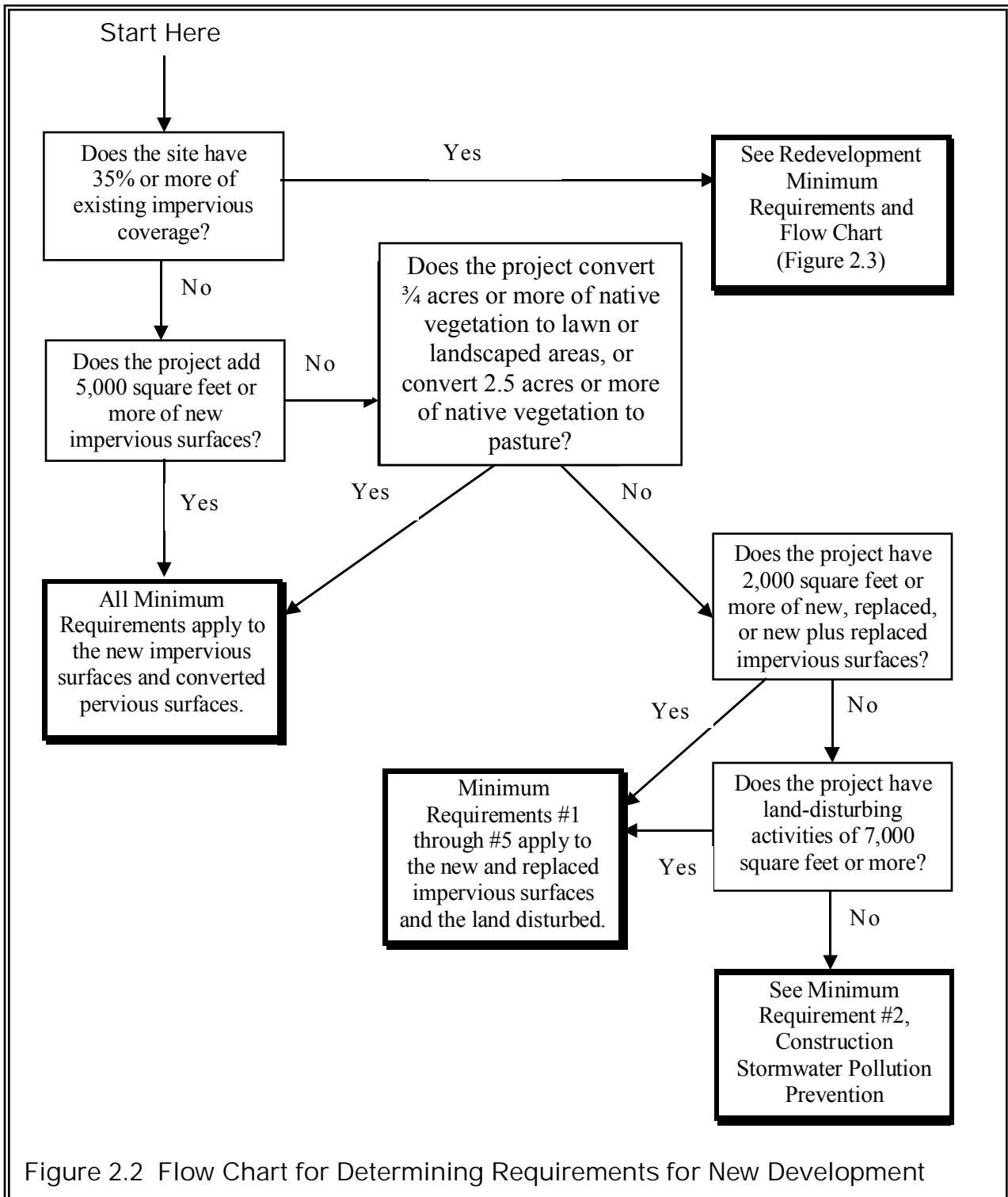
**Floodprone area** – Any land area susceptible to being inundated by flood water from any source.

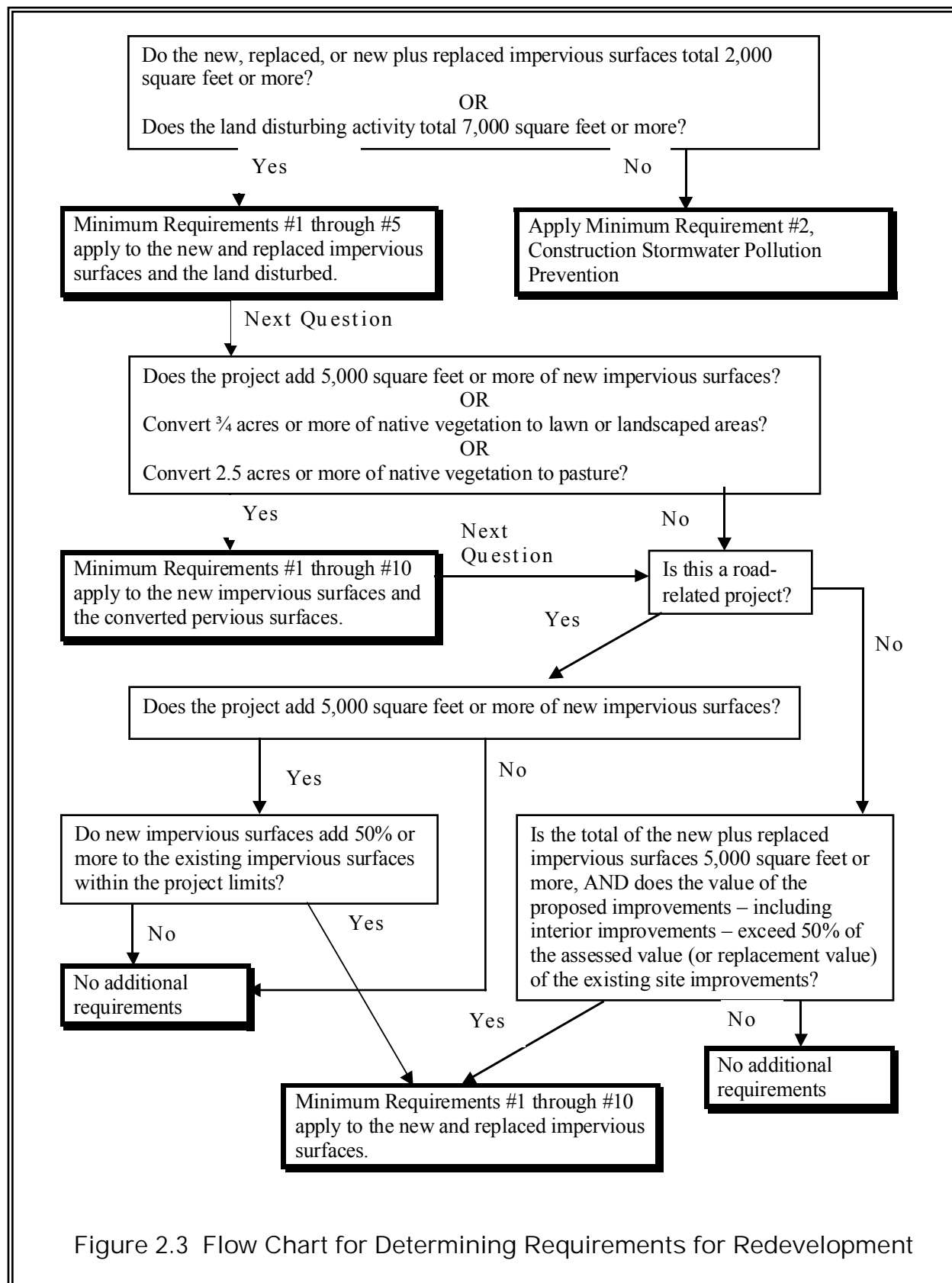
**New construction/structure** – For floodplain management purposes, new construction means structures for which the start of construction commences on or after the effective date of a floodplain management regulation adopted by a community and includes subsequent improvements to the structure. For flood insurance purposes, these structures are often referred to as “post-FIRM” structures.

**Special Flood Hazard Area (SFHA)** – Area subject to inundation by the base flood, designated Zone A, A1-30, AE, AH, AO, V, V1-V30, or VE.

City of Aberdeen

Storm Water Requirements





#### 2.4.1 New Development

**All new development that shall be required to comply with Minimum Requirement #2. In addition, new development that exceeds certain thresholds shall be required to comply with additional Minimum Requirements as follows.**

**The following new development shall comply with Minimum Requirements #1 through #5:**

- **Creates or adds 2,000 square feet, or greater, of new, replaced, or new plus replaced impervious surface area, or**
- **Has land disturbing activity of 7,000 square feet or greater,**

**The following new development shall comply with Minimum Requirements #1 through 10:**

- **Creates or adds 5,000 square feet, or more, of new impervious surface area, or**
- **Converts  $\frac{3}{4}$  acres, or more, of native vegetation to lawn or landscaped areas, or**
- **Converts 2.5 acres, or more, of native vegetation to pasture.**

#### Supplemental Guidelines

Basin planning is encouraged and may be used to tailor certain of the Minimum Requirements to a specific basin (Minimum Requirement #9). Treatment and flow control requirements may be achieved through construction of regional facilities. Such facilities must be operational prior to and must have capacity for new development.

#### 2.4.2 Redevelopment

**All redevelopment shall be required to comply with Minimum Requirement #2. In addition, all redevelopment that exceeds certain thresholds shall be required to comply with additional Minimum Requirements as follows.**

**The following redevelopment shall comply with Minimum Requirements #1 through #5 for the new and replaced impervious surfaces and the land disturbed:**

- **The new, replaced, or total of new plus replaced impervious surfaces is 2,000 square feet or more, or**
- **7,000 square feet or more of land disturbing activities.**

**The following redevelopment shall comply with Minimum Requirements #1 through 10 for the new impervious surfaces and converted pervious areas:**

- Adds 5,000 square feet or more of new impervious surfaces or,
- Converts  $\frac{3}{4}$  acres, or more, of native vegetation to lawn or landscaped areas, or
- Converts 2.5 acres, or more, of native vegetation to pasture.

If the runoff from the new impervious surfaces and converted pervious surfaces is not separated from runoff from other surfaces on the project site, the stormwater treatment facilities must be sized for the entire flow that is directed to them.

The local government may allow the Minimum Requirements to be met for an equivalent (flow and pollution characteristics) area within the same site. For public roads' projects, the equivalent area does not have to be within the project limits, but must drain to the same receiving water.

#### **Additional Requirements for the Project Site**

For road-related projects, runoff from the replaced and new impervious surfaces (including pavement, shoulders, curbs, and sidewalks) shall meet all the Minimum Requirements if the new impervious surfaces total 5,000 square feet or more and total 50% or more of the existing impervious surfaces within the project limits. The project limits shall be defined by the length of the project and the width of the right-of-way.

Other types of redevelopment projects shall comply with all the Minimum Requirements for the new and replaced impervious surfaces if the total of new plus replaced impervious surfaces is 5,000 square feet or more, and the valuation of proposed improvements – including interior improvements – exceeds 50% of the assessed value of the existing site improvements.

A local government may exempt or institute a stop-loss provision for redevelopment projects from compliance with Minimum Requirements for treatment, flow control, and wetlands protection as applied to the replaced impervious surfaces if the local government has adopted a plan and a schedule that fulfills those requirements in regional facilities.

#### **Objective**

Redevelopment projects have the same requirements as new development projects in order to minimize the impacts from new surfaces. To not discourage redevelopment projects, replaced surfaces aren't required to be brought up to new stormwater standards unless the noted cost or space

thresholds are exceeded. As long as the replaced surfaces have similar pollution-generating potential, the amount of pollutants discharged shouldn't be significantly different. However, if the redevelopment project scope is sufficiently large that the cost or space criteria noted above are exceeded, it is reasonable to require the replaced surfaces to be brought up to current stormwater standards. This is consistent with other utility standards. When a structure or a property undergoes significant remodeling, local governments often require the site to be brought up to new building code requirements (e.g., onsite sewage disposal systems, fire systems).

### Supplemental Guidelines

If runoff from new impervious surfaces, converted pervious surfaces, and replaced impervious surfaces (if the applicable cost or space threshold has been exceeded) is not separated from runoff from other existing surfaces within the project site or the site, the guidance in Volume III for offsite inflow shall be used to size the detention facilities.

Local governments can select from various bases for identifying projects that must retrofit the replaced impervious surfaces on the project site. Those can include:

- Exceeding 50% of the assessed value of the existing improvements;
- Exceeding 50% of the replacement value of the existing site improvements as determined by the Marshall Value System, or a similar valuation system; and
- Exceeding a certain dollar value of improvements; and
- Exceeding a certain ratio of the new impervious surfaces to the total of replaced plus new impervious surfaces.

A local government's thresholds for the application of stormwater controls to replaced impervious surfaces must be at least as stringent as Ecology's thresholds. Local governments should be prepared to demonstrate that by comparing the number and types of historical projects that would have been regulated using the Ecology thresholds versus the local government's thresholds.

Local governments are allowed to institute a stop-loss provision on the application of stormwater requirements to replaced impervious surfaces. A stop-loss provision is an upper limit on the extent to which a requirement is applied. For instance, there could be a maximum percentage of the estimated total project costs that are dedicated to meeting stormwater requirements. A project would not have to incur additional stormwater costs above that maximum though the standard redevelopment requirements will not be fully achieved. The allowance for a stop-loss



provision pertains to the extent that treatment, flow control and wetlands protection requirements are imposed on replaced impervious surfaces. It does not apply to meeting stormwater requirements for new impervious surfaces.

Local governments can also establish criteria for allowing redevelopment projects to pay a fee in lieu of constructing water quality or flow control facilities on a redeveloped site. At a minimum, the fee should be the equivalent of an engineering estimate of the cost of meeting all applicable stormwater requirements for the project. The local government should use such funds for the implementation of stormwater control projects that would have similar benefits to the same receiving water as if the project had constructed its required improvements. Expenditure of such funds is subject to other state statutory requirements.

Ecology cautions local governments about the potential long-term consequences of allowing a fee-in-lieu of stormwater facilities. Sites that are allowed to pay a fee continue without stormwater controls. If it is determined, through future basin planning for instance, that controls on such sites are necessary to achieve water quality goals or legal requirements, the public may bear the costs for providing those controls.

Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics should not be subject to redevelopment requirements except construction site erosion control.

Local governments are also encouraged to review all road projects for changes in elevations or drainage flowpath that could cause flooding, upland or stream erosion, or changes to discharges to wetlands. For example, adding curbs will result in redirecting flows and possibly causing new downstream impacts. The local government should set project-specific requirements to avoid or mitigate those impacts.

## 2.5 Minimum Requirements

This section describes the minimum requirements for stormwater management at development and redevelopment sites. Section 2.4 should be consulted to determine which requirements apply to any given project. Volumes II through V of this manual present Best Management Practices (BMPs) for use in meeting the Minimum Requirements.

**Throughout this Chapter, guidance to meet the requirements of the Puget Sound Water Quality Management Plan is written in bold and supplemental guidelines that serve as advice and other materials are not in bold.**

### 2.5.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

**All projects meeting the thresholds in Section 2.4 shall prepare a Stormwater Site Plan for local government review. Stormwater Site Plans shall be prepared in accordance with Chapter 3 of this volume.**

#### Objective

The 2,000 square feet threshold for impervious surfaces and 7,000 square foot threshold for land disturbance are chosen to capture most single family home construction and their equivalent. Note that the scope of the stormwater site plan only covers compliance with Minimum Requirements #2 through #5 if the thresholds of 5,000 square feet of impervious surface or conversion of  $\frac{3}{4}$  acre of native vegetation to lawn or landscape, or conversion of 2.5 acres of native vegetation to pasture are not exceeded.

#### Supplemental guidelines

Projects proposed by departments and agencies within the local government with jurisdiction must comply with this requirement. The local government shall determine the process for ensuring proper project review, inspection, and compliance by its own departments and agencies.

### 2.5.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

**All new development and redevelopment shall comply with Construction SWPP Elements #1 through #12 below.**

**Projects in which the new, replaced, or new plus replaced impervious surfaces total 2,000 square feet or more, or disturb 7,000 square feet or more of land must prepare a Construction SWPP Plan (SWPPP) as part of the Stormwater Site Plan (see 2.5.1). Each of the twelve elements must be considered and included in the Construction SWPPP unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the narrative of the SWPPP.**

**Projects that add or replace less than 2,000 square feet of impervious surface or disturb less than 7,000 square feet of land are not required to prepare a Construction SWPPP, but must consider all of the twelve Elements of Construction Stormwater Pollution Prevention and develop controls for all elements that pertain to the project site.**

### **Element 1: Mark Clearing Limits**

- **Prior to beginning land disturbing activities, including clearing and grading, all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area should be clearly marked, both in the field and on the plans, to prevent damage and offsite impacts.**
- **Plastic, metal, or stake wire fence may be used to mark the clearing limits.**

### **Element 2: Establish Construction Access**

- **Construction vehicle access and exit shall be limited to one route if possible.**
- **Access points shall be stabilized with quarry spall or crushed rock to minimize the tracking of sediment onto public roads.**
- **Wheel wash or tire baths should be located on-site, if applicable.**
- **Public roads shall be cleaned thoroughly at the end of each day. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area. Street washing will be allowed only after sediment is removed in this manner.**
- **Street wash wastewater shall be controlled by pumping back on-site, or otherwise be prevented from discharging into systems tributary to state surface waters.**

### **Element 3: Control Flow Rates**

- **Properties and waterways downstream from development sites shall be protected from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site, as required by local plan approval authority.**
- **Downstream analysis is necessary if changes in flows could impair or alter conveyance systems, streambanks, bed sediment or aquatic habitat. See Chapter 3 for offsite analysis guidance.**
- **Where necessary to comply with Minimum Requirement #7, Stormwater retention/detention facilities shall be constructed as one of the first steps in grading. Detention facilities shall be functional prior to construction of site improvements (e.g. impervious surfaces).**
- **The local permitting agency may require pond designs that provide additional or different stormwater flow control if necessary to address local conditions or to protect properties and**

waterways downstream from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site.

- If permanent infiltration ponds are used for flow control during construction, these facilities should be protected from siltation during the construction phase.

#### Element 4: Install Sediment Controls

- The duff layer, native topsoil, and natural vegetation shall be retained in an undisturbed state to the maximum extent practicable.
- Prior to leaving a construction site, or prior to discharge to an infiltration facility, stormwater runoff from disturbed areas shall pass through a sediment pond or other appropriate sediment removal BMP. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Element #3, bullet #1. Full stabilization means concrete or asphalt paving; quarry spalls used as ditch lining; or the use of rolled erosion products, a bonded fiber matrix product, or vegetative cover in a manner that will fully prevent soil erosion. The Local Permitting Authority shall inspect and approve areas stabilized by means other than pavement or quarry spalls.
- Sediment ponds, vegetated buffer strips, sediment barriers or filters, dikes, and other BMPs intended to trap sediment on-site shall be constructed as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place.
- Earthen structures such as dams, dikes, and diversions shall be seeded and mulched according to the timing indicated in Element #5.

#### Element 5: Stabilize Soils

- All exposed and unworked soils shall be stabilized by application of effective BMPs, that protect the soil from the erosive forces of raindrop impact and flowing water, and wind erosion.
- From October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. This condition applies to all soils on site, whether at final grade or not. These time limits may be adjusted by the local permitting authority if it can be shown that the average time between storm events justifies a different standard.

- **Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, soil application of polyacrylamide (PAM), early application of gravel base on areas to be paved, and dust control.**
- **Soil stabilization measures selected should be appropriate for the time of year, site conditions, estimated duration of use, and potential water quality impacts that stabilization agents may have on downstream waters or ground water.**
- **Soil stockpiles must be stabilized and protected with sediment trapping measures.**
- **Work on linear construction sites and activities, including right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall not exceed the capability of the individual contractor for his portion of the project to install the bedding materials, roadbeds, structures, pipelines, and/or utilities, and to re-stabilize the disturbed soils, meeting the timing conditions listed above.**

#### **Element 6: Protect Slopes**

- **Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion.**
- **Consider soil type and its potential for erosion.**
- **Reduce slope runoff velocities by reducing the continuous length of slope with terracing and diversions, reduce slope steepness, and roughen slope surface.**
- **Divert upslope drainage and run-on waters from off-site with interceptors at top of slope. Off-site stormwater should be handled separately from stormwater generated on the site. Diversion of off-site stormwater around the site may be a viable option. Diverted flows shall be redirected to the natural drainage location at or before the property boundary.**
- **Contain downslope collected flows in pipes, slope drains, or protected channels.**
- **Provide drainage to remove ground water intersecting the slope surface of exposed soil areas.**
- **Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.**
- **Check dams shall be placed at regular intervals within trenches that are cut down a slope.**
- **Stabilize soils on slopes, as specified in Element #5.**

#### **Element 7: Protect Drain Inlets**

- **All storm drain inlets made operable during construction shall be protected so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment.**
- **All approach roads shall be kept clean, and all sediment and street wash water shall not be allowed to enter storm drains without prior and adequate treatment unless treatment is provided before the storm drain discharges to waters of the State.**

#### **Element 8: Stabilize Channels and Outlets**

- **All temporary on-site conveyance channels shall be designed, constructed and stabilized to prevent erosion from the expected velocity of flow from a 2 year, 24-hour frequency storm for the developed condition.**
- **Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent streambanks, slopes and downstream reaches shall be provided at the outlets of all conveyance systems.**

#### **Element 9: Control Pollutants**

- **All pollutants, including waste materials and demolition debris, that occur on-site during construction shall be handled and disposed of in a manner that does not cause contamination of stormwater.**
- **Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste).**
- **Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.**
- **Wheel wash, or tire bath wastewater, shall be discharged to a separate on-site treatment system or to the sanitary sewer.**
- **Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations shall be followed for application rates and procedures.**

- **Management of pH-modifying sources shall prevent contamination of runoff and stormwater collected on the site. These sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters.**

#### **Element 10: Control De-Watering**

- **All foundation, vault, and trench de-watering water, which has similar characteristics to stormwater runoff at the site, shall be discharged into a controlled conveyance system, prior to discharge to a sediment trap or sediment pond. Channels must be stabilized, as specified in Element #8.**
- **Clean, non-turbid de-watering water, such as well-point ground water, can be discharged to systems tributary to state surface waters, as specified in Element #8, provided the de-watering flow does not cause erosion or flooding of the receiving waters. These clean waters should not be routed through sediment ponds with stormwater.**
- **Highly turbid or otherwise contaminated dewatering water, such as from construction equipment operation, clamshell digging, concrete tremie pour, or work inside a cofferdam, shall be handled separately from stormwater at the site.**
- **Other disposal options, depending on site constraints, may include: 1) infiltration, 2) transport off-site in vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters, 3) on-site treatment using chemical treatment or other suitable treatment technologies, or 4) sanitary sewer discharge with local sewer district approval if there is no other option.**

#### **Element 11: Maintain BMPs**

- **All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. All maintenance and repair shall be conducted in accordance with BMPs.**
- **Sediment control BMPs shall be inspected weekly or after a runoff-producing storm event during the dry season and daily during the wet season.**
- **All temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or**

**after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal of BMPs or vegetation shall be permanently stabilized.**

#### **Element 12: Manage The Project**

- **Phasing of Construction - Development projects shall be phased where feasible in order to prevent, to the maximum extent practicable, the transport of sediment from the development site during construction. Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities for any phase.**

**Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. When establishing these permitted clearing and grading areas, consideration should be given to minimizing removal of existing trees and minimizing disturbance/compaction of native soils except as needed for building purposes. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by local jurisdictions, shall be delineated on the site plans and the development site.**

- **Seasonal Work Limitations - From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the construction site through a combination of the following:**
  1. **Site conditions including existing vegetative coverage, slope, soil type and proximity to receiving waters; and**
  2. **Limitations on activities and the extent of disturbed areas; and**
  3. **Proposed erosion and sediment control measures.**

**Based on the information provided, and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance. If, during the course of any construction activity or soil disturbance during the seasonal limitation period, silt-laden runoff leaving the construction site causes a violation of the surface water quality standard or if clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained, the local permitting authority shall take enforcement action,**



including, but not limited to a notice of violation, administrative order, penalty, or stop-work order.

The following activities are exempt from the seasonal clearing and grading limitations:

1. Routine maintenance and necessary repair of erosion and sediment control BMPs;
  2. Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and
  3. Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.
- **Coordination with Utilities and Other Contractors** - The primary project proponent shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.
  - **Inspection and Monitoring** - All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function.

A Certified Professional in Erosion and Sediment Control shall be identified in the Construction SWPPP and shall be on-site or on-call at all times. Certification may be through the Washington State Department of Transportation/Associated General Contractors (WSDOT/AGC) Construction Site Erosion and Sediment Control Certification Program or any equivalent local or national certification and/or training program.

Sampling and analysis of the stormwater discharges from a construction site may be necessary on a case-by-case basis to ensure compliance with standards. Monitoring and reporting requirements may be established by the local permitting authority when necessary.

Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, the SWPPP shall be modified, as appropriate, in a timely manner.

- **Maintenance of the Construction SWPPP** - The Construction SWPPP shall be retained on-site or within reasonable access to the site. The Construction SWPPP shall be modified whenever there is a significant change in the design, construction, operation, or maintenance of any BMP.

## Objective

To control erosion and prevent sediment and other pollutants from leaving the site during the construction phase of a project.

## Supplemental Guidelines

If a Construction SWPPP is found to be inadequate (with respect to erosion and sediment control requirements), then the Plan Approval Authority<sup>1</sup> within the Local Government should require that other BMPs be implemented, as appropriate.

The Plan Approval Authority may allow development of generic Construction SWPPP's that apply to commonly conducted public road activities, such as road surface replacement, that trigger this minimum requirement.

### 2.5.3 Minimum Requirement #3: Source Control of Pollution

## Objective

**All known, available and reasonable source control BMPs shall be applied to all projects. Source control BMPs shall be selected, designed, and maintained according to this manual.**

The intention of source control BMPs is to prevent stormwater from coming in contact with pollutants. They are a cost-effective means of reducing pollutants in stormwater, and, therefore, should be a first consideration in all projects

## Supplemental Guidelines

An adopted and implemented basin plan (Minimum Requirement #9) or a Total Maximum Daily Load (TMDL, also known as a Water Clean-up Plan) may be used to develop more stringent source control requirements that are tailored to a specific basin.

Source Control BMPs include Operational BMPs and Structural Source Control BMPs. See Volume IV for design details of these BMPs. For construction sites, see Volume II, Chapter 4.

Structural source control BMPs should be identified in the stormwater site plan and should be shown on site plans submitted for local government review.

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<sup>1</sup> The Plan Approval Authority is defined as that department within a local government that has been delegated authority to approve stormwater site plans.

#### 2.5.4 Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

**Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. All outfalls require energy dissipation.**

##### Objective

To preserve and utilize natural drainage systems to the fullest extent because of the multiple stormwater benefits these systems provide; and to prevent erosion at and downstream of the discharge location.

##### Supplemental Guidelines

Creating new drainage patterns results in more site disturbance and more potential for erosion and sedimentation during and after construction. Creating new discharge points can create significant stream channel erosion problems as the receiving water body typically must adjust to the new flows. Diversions can cause greater impacts than would otherwise occur by discharging runoff at the natural location.

Where no conveyance system exists at the adjacent downgradient property line and the discharge was previously unconcentrated flow or significantly lower concentrated flow, then measures must be taken to prevent downgradient impacts. Drainage easements from downstream property owners may be needed and should be obtained prior to approval of engineering plans.

The following discharge requirement is recommended:

Where no conveyance system exists at the abutting downstream property line and the natural (existing) discharge is unconcentrated, any runoff concentrated by the proposed project must be discharged as follows:

- a) If the 100-year peak discharge is less than or equal to 0.2 cfs under existing conditions and will remain less than or equal to 0.2 cfs under developed conditions, then the concentrated runoff may be discharged onto a rock pad or to any other system that serves to disperse flows.
- b) If the 100-year peak discharge is less than or equal to 0.5 cfs under existing conditions and will remain less than or equal to 0.5 cfs under developed conditions, then the concentrated runoff may be discharged through a dispersal trench or other dispersal system, provided the applicant can demonstrate that there will be no significant adverse impact to downhill properties or drainage systems.

- c) If the 100-year peak discharge is greater than 0.5 cfs for either existing or developed conditions, or if a significant adverse impact to downgradient properties or drainage systems is likely, then a conveyance system must be provided to convey the concentrated runoff across the downstream properties to an acceptable discharge point (i.e., an enclosed drainage system or open drainage feature where concentrated runoff can be discharged without significant adverse impact).

Stormwater control or treatment structures should not be located within the expected 25-year water level elevations for salmonid-bearing waters. Such areas may provide off-channel habitat for juvenile salmonids and salmonid fry. Designs for outfall systems to protect against adverse impacts from concentrated runoff are included in Volume V, Chapter 4.

#### 2.5.5 Minimum Requirement #5: On-site Stormwater Management

**Projects shall employ On-site Stormwater Management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing flooding or erosion impacts. Roof Downspout Control BMPs, functionally equivalent to those described in Chapter 3 of Volume III, and Dispersion and Soil Quality BMPs, functionally equivalent to those in Chapter 5 of Volume V, shall be required to reduce the hydrologic disruption of developed sites.**

##### Objective

To use inexpensive practices on individual properties to reduce the amount of disruption of the natural hydrologic characteristics of the site.

##### Supplemental Guidelines

“Flooding and erosion impacts” include impacts such as flooding of septic systems, crawl spaces, living areas, outbuildings, etc.; increased ice or algal growth on sidewalks/roadways; earth movement/settlement, increased landslide potential; erosion and other potential damage.

Recent research indicates that current techniques in residential, commercial, and industrial land development cause gross disruption of the natural hydrologic cycle with severe impacts to water and water-related natural resources. Based upon gross level applications of continuous runoff modeling and assumptions concerning minimum flows needed to maintain beneficial uses, watersheds must retain the majority of their natural vegetation cover and soils, and developments must meet the Flow Control Minimum Requirement of this chapter, in order to avoid significant natural resource degradation in lowland streams.

The Roof Downspout Control BMPs described in Chapter 3 of Volume III, and the Dispersion and Soil Quality BMPs in Chapter 5 of Volume V are insufficient to prevent significant hydrologic disruptions and impacts to streams and their natural resources. Therefore, local governments should look for opportunities to encourage and require additional BMPs such as those in Sections 5.2 through 5.4 of Volume V through updates to their site development standards and land use plans.

#### 2.5.6 Minimum Requirement #6: Runoff Treatment

##### Thresholds

**The following require construction of stormwater treatment facilities (see Table 2.1):**

- **Projects in which the total of effective, pollution-generating impervious surface (PGIS) is 5,000 square feet or more in a threshold discharge area of the project, or**
- **Projects in which the total of pollution-generating pervious surfaces (PGPS) is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site.**

Table 2.1 Treatment Requirements by Threshold Discharge Area				
	< ¾ acres of PGPS	≥ ¾ acres PGPS	< 5,000 sf PGIS	≥ 5,000 sf PGIS
Treatment Facilities		✓		✓
Onsite Stormwater BMPs	✓	✓	✓	✓

PGPS = pollution-generating pervious surfaces

PGIS = pollution-generating impervious surfaces

sf = square feet

##### Treatment Facility Sizing

**Water Quality Design Storm Volume:** The volume of runoff predicted from a 24-hour storm with a 6-month return frequency (a.k.a., 6-month, 24-hour storm). Wetpool facilities are sized based upon the volume of runoff predicted through use of the Natural Resource Conservation Service curve number equations in Chapter 2 of Volume III, for the 6-month, 24-hour storm.

##### Water Quality Design Flow Rate:

- **Preceding Detention Facilities or when Detention Facilities are not required: The flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous runoff model,**

**will be treated. Design criteria for treatment facilities are assigned to achieve the applicable performance goal at the water quality design flow rate (e.g., 80% TSS removal).**

- **Downstream of Detention Facilities: The full 2-year release rate from the detention facility.**

**Alternative methods can be used if they identify volumes and flow rates that are at least equivalent.**

**That portion of any development project in which the above PGIS or PGPS thresholds are not exceeded in a threshold discharge area shall apply On-site Stormwater Management BMPs in accordance with Minimum Requirement #5.**

Treatment Facility Selection, Design, and Maintenance

**Stormwater treatment facilities shall be:**

- **selected in accordance with the process identified in Chapter 4 of Volume I,**
- **designed in accordance with the design criteria in Volume V, and**
- **maintained in accordance with the maintenance schedule in Volume V.**

Additional Requirements

**Direct discharge of untreated stormwater from pollution-generating impervious surfaces to ground water is prohibited, except for the discharge achieved by infiltration or dispersion of runoff from residential sites through use of On-site Stormwater Management BMPs.**

Objective

The purpose of runoff treatment is to reduce pollutant loads and concentrations in stormwater runoff using physical, biological, and chemical removal mechanisms so that beneficial uses of receiving waters are maintained and, where applicable, restored. When site conditions are appropriate, infiltration can potentially be the most effective BMP for runoff treatment.

Supplemental Guidelines

See Volume V for more detailed guidance on selection, design, and maintenance of treatment facilities. The water quality design storm volume and flow rates are intended to capture and effectively treat about 90-95% of the annual runoff volume in western Washington. See Appendix I-B for background on their derivation.

Volume V includes performance goals for Basic, Enhanced, Phosphorus, and Oil Control treatment, and a menu of facility options for each treatment type. Treatment facilities that are selected from the appropriate menu and designed in accordance with their design criteria are presumed to meet the applicable performance goals.

An adopted and implemented basin plan (Minimum Requirement #9), or a Total Maximum Daily Load (TMDL - also known as a Water Clean-up Plan) may be used to develop runoff treatment requirements that are tailored to a specific basin. However, treatment requirements shall not be less than that achieved by facilities in the Basic Treatment Menu (see Volume V, Chapter 3).

Treatment facilities applied consistent with this manual are presumed to meet the requirement of state law to provide all known available and reasonable methods of treatment (RCW 90.52.040, RCW 90.48.010). This technology-based treatment requirement does not excuse any discharge from the obligation to apply whatever technology is necessary to comply with state water quality standards, Chapter 173-201A WAC; state ground water quality standards, Chapter 173-200 WAC; state sediment management standards, Chapter 173-204 WAC; and the underground injection control program, Chapter 173-218 WAC. Additional treatment to meet those standards may be required by federal, state, or local governments.

Infiltration through use of On-site Stormwater Management BMPs can provide both treatment of stormwater, through the ability of certain soils to remove pollutants, and volume control of stormwater, by decreasing the amount of water that runs off to surface water. Infiltration through engineered treatment facilities that utilize the natural soil profile can also be very effective at treating stormwater runoff, but pretreatment must be applied and soil conditions must be appropriate to achieve effective treatment while not impacting ground water resources. See Chapter 6 of Volume V for design details.

Discharge of pollution-generating surfaces into a dry well, after pretreatment for solids reduction, can be acceptable if the soil conditions provide sufficient treatment capacity. Dry wells into gravelly soils are not likely to have sufficient treatment capability. They must be preceded by at least a basic treatment BMP. See Volume V, Chapters 2 and 7 for details.

Impervious surfaces that are “fully dispersed” in accordance with BMP T5.30 in Volume V are not considered effective impervious surfaces. PGIS surfaces that are “dispersed” in accordance with the BMPs in Section 5.1 of Volume V are considered effective impervious surfaces. Porous pavers and Modular grid pavements are assigned a lower curve number (if using single event hydrology to size wetpools) and lower surface runoff calibrations (if

using continuous runoff modeling). See Volume III for a more complete description of hydrologic credits for Onsite Stormwater Management BMPs.

#### 2.5.7 Minimum Requirement #7: Flow Control

##### Applicability

**Projects must provide flow control to reduce the impacts of increased stormwater runoff from new impervious surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system, into a fresh water - except for:**

**discharges into the Columbia River, Lakes Sammamish, Silver (Cowlitz Co.), Union (King Co.), Washington, and Whatcom;**

**discharges into a wetland; (See Minimum Requirement #8 for flow control requirements applicable to discharges to wetlands)**

**Any exempted areas shall meet the following requirements:**

- **The area must be drained by a conveyance system that is comprised entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection, etc.) and extends to the ordinary high water line of the receiving water; and**
- **Any erodible elements of the manmade conveyance system for the area must be adequately stabilized to prevent erosion; and**
- **Surface water from the area must not be diverted from or increased to an existing wetland, stream, or near-shore habitat sufficient to cause a significant adverse impact.**

**Local governments may petition Ecology to exempt projects in additional areas. A petition must justify the proposed exemption based upon a hydrologic analysis that demonstrates that the potential stormwater runoff from the exempted area will not significantly increase the erosion forces on the stream channel nor have near field impacts.**

##### Thresholds

**The following require construction of flow control facilities and/or land use management BMPs that will achieve the standard requirement for western Washington (see Table 2.2):**

- **Projects in which the total of effective impervious surfaces is 10,000 square feet or more in a threshold discharge area, or**



- Projects that convert  $\frac{3}{4}$  acres or more of native vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site, or
- Projects that through a combination of effective impervious surfaces and converted pervious surfaces, cause a 0.1 cubic feet per second increase in the 100-year flow frequency from a threshold discharge area as estimated using the Western Washington Hydrology Model or other approved model.

That portion of any development project in which the above thresholds are not exceeded in a threshold discharge area shall apply Onsite Stormwater Management BMPs in accordance with Minimum Requirement #5.

Table 2.2 Flow Control Requirements by Threshold Discharge Area		
	Flow Control Facilities	On-site Stormwater Management BMPs
< $\frac{3}{4}$ acres conversion to lawn/landscape, or < 2.5 acres to pasture		✓
≥ $\frac{3}{4}$ acres conversion to lawn/landscape, or ≥ 2.5 acres to pasture	✓	✓
< 10,000 square feet of effective impervious area		✓
≥ 10,000 square feet of effective impervious area	✓	✓
≥ 0.1 cubic feet per second increase in the 100-year flood frequency	✓	✓

Standard Requirement

The following requirement applies to the geographic areas west of the Cascades, including all of the following counties:

Clallam	Pacific
Clark	Pierce
Cowlitz	San Juan
Grays Harbor	Skagit
Island	Skamania
Jefferson	Snohomish
King	Thurston
Kitsap	Wahkiakum
Lewis	Whatcom
Mason	

**Stormwater discharges shall match developed discharge durations to predeveloped durations for the range of predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.**

**The pre-developed condition to be matched shall be a forested land cover unless reasonable, historic information is provided that indicates the site was prairie prior to settlement (modeled as “pasture” in the Western Washington Hydrology Model). This standard requirement is waived for sites that will reliably infiltrate all the runoff from impervious surfaces and converted pervious surfaces.**

#### **Western Washington Alternative Requirement**

**An alternative requirement may be established through application of watershed-scale hydrological modeling and supporting field observations. Possible reasons for an alternative flow control requirement include:**

- **Establishment of a stream-specific threshold of significant bedload movement other than the assumed 50% of the 2-year peak flow;**
- **Zoning and Land Clearing Ordinance restrictions that, in combination with an alternative flow control standard, maintain or reduce the naturally occurring erosive forces on the stream channel; or**
- **A duration control standard is not necessary for protection, maintenance, or restoration of designated beneficial uses or Clean Water Act compliance.**

#### **Additional Requirement**

**Flow Control BMPs shall be selected, designed, and maintained according to a local government manual deemed equivalent to this manual.**

#### **Objective**

To prevent increases in the stream channel erosion rates that are characteristic of natural conditions (i.e., prior to disturbance by European settlement). The standard intends to maintain the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions. That threshold is assumed to be 50% of the 2-year peak flow. Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production.

## Supplemental Guidelines

Reduction of flows through infiltration decreases stream channel erosion and helps to maintain base flow throughout the summer months. However, infiltration should only be used where ground water quality is not threatened by such discharges.

Volume III includes a description of the Western Washington Hydrology Model. The model provides credits for use of certain downspout designs and other types of Onsite Stormwater Management BMPs described in Volume V. Using those BMPs reduces the size of the required flow control facilities.

Application of sufficient types of Onsite Stormwater Management BMPs can result in reducing the effective impervious area and the converted pervious areas such that a flow control facility is not required. Application of “Full Dispersion”, BMP T5.30, also results in eliminating the flow control facility requirement for those areas that are “fully dispersed.”

## Interim Guideline

Local governments have a choice to make concerning a flow control standard to use until a flow duration standard is adopted and a continuous rainfall/runoff model and flow routing program (for sizing orifices and ponds) are available for use. They can continue to use the peak flow standard of the 1992 Puget Sound manual, or use a peak flow standard that approximates the results that the proposed flow duration standard would achieve.

By adjusting the target peak flow standard, restricting use of variables in the Santa Barbara Urban Hydrograph (SBUH) hydrologic analysis, and applying a volume correction factor, one can estimate the orifice sizes and detention volumes that the proposed flow duration standard would indicate. The following explains how to adjust the SBUH approach to obtain results similar to the output from the King County Runoff Time Series (an application of the Hydrologic Simulation Program – Fortran) with the proposed flow duration standard as the target.

**Adjusted target peak flow standard.** Limit the peak rate of runoff from individual development sites to 50 percent of the pre-developed condition 2-year, 24-hour design storm. Limit the peak rate from the 10-year, 24-hour design storm to the pre-developed condition peak rate from the 2-year, 24-hour design storm. Limit the peak rate from the 100-year, 24-hour design storm to the pre-developed condition peak rate from the 10-year, 24-hour design storm.

**Restricted variable assumptions.** The flow path length assumed for sheet flow runoff in the pre-developed condition calculations must not be less than 300 feet.

The Manning's effective roughness coefficient for pre-developed forested conditions should be 0.80. For pasture conditions, the coefficient should be 0.15.

In the table of curve numbers in Volume III, Chapter 2, the curve numbers for pre-developed forest and pasture conditions must be selected from the "fair" category.

**Volume correction factor:** In addition to the above, the pond volume correction factor (applicable to detention and retention facilities) identified in Volume III, Chapter 2 should be used where the pre-developed condition is modeled as pasture. When enlarging the pond to accommodate the volume correction factor, remember to not change the pond depth or the design of the outlet structure. Thus, an increase in the surface area is necessary.

#### 2.5.8 Minimum Requirement #8: Wetlands Protection

##### Applicability

**The requirements below apply only to projects whose stormwater discharges into a wetland, either directly or indirectly through a conveyance system. These requirements must be met in addition to meeting Minimum Requirement #6, Runoff Treatment.**

##### Thresholds

**The thresholds identified in Minimum Requirement #6 – Runoff Treatment, and Minimum Requirement #7 – Flow Control shall also be applied for discharges to wetlands.**

##### Standard Requirement

**Discharges to wetlands shall maintain the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses. A wetland can be considered for hydrologic modification and/or stormwater treatment in accordance with Guide Sheet 1B in Appendix I-D.**

##### Additional Requirements

**The standard requirement does not excuse any discharge from the obligation to apply whatever technology is necessary to comply with state water quality standards, Chapter 173-201A WAC, or state**

**ground water standards, Chapter 173-200 WAC. Additional treatment requirements to meet those standards may be required by federal, state, or local governments.**

**Stormwater treatment and flow control facilities shall not be built within a natural vegetated buffer, except for:**

- **necessary conveyance systems as approved by the local government; or**
- **as allowed in wetlands approved for hydrologic modification and/or treatment in accordance with Guidesheet 1B.**

**An adopted and implemented basin plan (Minimum Requirement #9), or a Total Maximum Daily Load (TMDL, also known as a Water Clean-up Plan) may be used to develop requirements for wetlands that are tailored to a specific basin.**

#### Objective

To ensure that wetlands receive the same level of protection as any other waters of the state. Wetlands are extremely important natural resources which provide multiple stormwater benefits, including ground water recharge, flood control, and stream channel erosion protection. They are easily impacted by development unless careful planning and management are conducted. Wetlands can be severely degraded by stormwater discharges from urban development due to pollutants in the runoff and also due to disruption of natural hydrologic functioning of the wetland system. Changes in water levels and the frequency and duration of inundations are of particular concern.

#### Supplemental Guidelines

Appendix I-D, "Wetlands and Stormwater Management Guidelines" is an amended version of Chapter 14 of the publication, "Wetlands and Urbanization, Implications for the Future", the final report of the Puget Sound Wetland and Stormwater Management Research Program, 1997. It should be used for discharges to natural wetlands and wetlands constructed as mitigation. The amendments were added to Guidesheets 1A, 2B, and 2C to improve clarity of intent and to make them compatible with the updated manual. While it is always necessary to pre-treat stormwater prior to discharge to a wetland, there are limited circumstances where wetlands may be used for additional treatment and detention of stormwater. These situations are considered in Guide Sheet 1B of the guidelines.

Note that if selective runoff bypass is an alternative being considered to maintain the hydroperiod, the hydrologic analysis must consider the

impacts of the bypassed flow. For instance, if the bypassed flow is eventually directed to a stream, the flow duration standard, Minimum Requirement #7, applies to the bypass.

#### 2.5.9 Minimum Requirement #9: Basin/Watershed Planning

**Projects may be subject to equivalent or more stringent minimum requirements for erosion control, source control, treatment, and operation and maintenance, and alternative requirements for flow control and wetlands hydrologic control as identified in Basin/Watershed Plans. Basin/Watershed plans shall evaluate and include, as necessary, retrofitting urban stormwater BMPs into existing development and/or redevelopment in order to achieve watershed-wide pollutant reduction and flow control goals that are consistent with requirements of the federal Clean Water Act. Standards developed from basin plans shall not modify any of the above minimum requirements until the basin plan is formally adopted and implemented by the local governments within the basin, and approved or concurred with by Ecology.**

##### Objective

To promote watershed-based planning as a means to develop and implement comprehensive, water quality protection measures. Primary objectives of basin planning are to reduce pollutant loads and hydrologic impacts to surface and ground waters in order to protect beneficial uses.

##### Supplemental Guidelines

Though Minimum Requirements #1 through #8 establish general standards for individual sites, they do not evaluate the overall pollution impacts and protection opportunities that could exist at the watershed level. In order for a basin plan to serve as a means of modifying the minimum requirements the following conditions must be met:

- the plan must be formally adopted by all jurisdictions with responsibilities under the plan and
- all ordinances or regulations called for by the plan must be in effect.

This is what is meant by an adopted and implemented basin plan.

Basin planning provides a mechanism by which the minimum requirements and implementing BMP's can be evaluated and refined based on an analysis of an entire watershed. Basin plans are especially well suited to develop control strategies to address impacts from future development and to correct specific problems whose sources are known or suspected. Basin plans can be effective at addressing both long-term

cumulative impacts of pollutant loads and short-term acute impacts of pollutant concentrations, as well as hydrologic impacts to streams, wetlands, and ground water resources. The USGS has developed software called “GenScn” (Generation and Analysis of Model Simulation Scenarios) that can facilitate basin planning. The program is a Windows-based use of HSPF that predicts water quality and quantity changes for multiple scenarios of land use and water management within a basin.

Examples of how Basin Planning can alter the minimum requirements of this manual are given in Appendix I-A.

#### 2.5.10 Minimum Requirement #10: Operation and Maintenance

**An operation and maintenance manual that is consistent with the provisions in Volume V of this manual shall be provided for all proposed stormwater facilities and BMPs, and the party (or parties) responsible for maintenance and operation shall be identified. At private facilities, a copy of the manual shall be retained onsite or within reasonable access to the site, and shall be transferred with the property to the new owner. For public facilities, a copy of the manual shall be retained in the appropriate department. A log of maintenance activity that indicates what actions were taken shall be kept and be available for inspection by the local government.**

##### Objective

To ensure that stormwater control facilities are adequately maintained and operated properly.

##### Supplemental Guidelines

Inadequate maintenance is a common cause of failure for stormwater control facilities. The description of each BMP in Volumes II, III, and V includes a section on maintenance. Chapter 4 of Volume V includes a schedule of maintenance standards for drainage facilities. Local governments should consider more detailed requirements for maintenance logs, such as a record of where wastes were disposed.

## 2.6 Optional Guidance

The following guidance is offered as recommendations to local governments. Ecology considers their use to be in the best interest of the general public and the environment but will not make their implementation a requirement for manual equivalency.

### 2.6.1 Optional Guidance #1: Financial Liability

Performance bonding or other appropriate financial guarantees shall be required for all projects to ensure construction of drainage facilities in compliance with these standards. In addition, a project applicant shall post a two-year financial guarantee of the satisfactory performance and maintenance of any drainage facilities that are scheduled to be assumed by the local government for operation and maintenance.

#### Objective

To ensure that development projects have adequate financial resources to fully implement stormwater management plan requirements and that liability is not unduly incurred by local governments.

#### Supplemental Guidelines

The type of financial instrument required is less important than ensuring that there are adequate funds available in the event that non-compliance occurs.

### 2.6.2 Optional Guidance #2: Off Site Analysis and Mitigation

Development projects that discharge stormwater offsite shall submit an offsite analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project and that proposes appropriate mitigation of those impacts. An initial qualitative analysis shall extend downstream for the entire flow path from the project site to the receiving water or up to one mile, whichever is less. If a receiving water is within one-quarter mile, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream to a point where any backwater effects created by the project cease. Upon review of the qualitative analysis, the local administrator may require that a quantitative analysis be performed.

The existing or potential impacts to be evaluated and mitigated shall include:

- Conveyance system capacity problems;
- Localized flooding;
- Upland erosion impacts, including landslide hazards;
- Stream channel erosion at the outfall location;
- Violations of surface water quality standards as identified in a Basin Plan or a TMDL (Water Clean-up Plan); or violations of ground water standards in a wellhead protection area.



## Objective

To identify and evaluate offsite water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by a proposed project, and to determine measures for preventing impacts and for not aggravating existing impacts. Aggravated shall mean increasing the frequency of occurrence and/or severity of a problem.

## Supplemental Guidelines

Ecology highly recommends that local governments adopt similar offsite analysis requirements. Some of the most common and potentially destructive impacts of land development are erosion of downgradient properties, localized flooding, and slope failures. These are caused by increased surface water volumes and changed runoff patterns. Because these problems frequently do not have a related water quality impact, Ecology is not listing offsite analysis as a minimum requirement. However, taking the precautions of offsite analysis could prevent substantial property damage and public safety risks.

Projects should be required to initially submit, with the permit application, a qualitative analysis of each downstream system leaving a site. The analysis should accomplish four tasks:

### Task 1 – Define and map the study area

Submission of a site map showing property lines; a topographic map (at a minimum a USGS 1:24000 Quadrangle Topographic map) showing site boundaries, study area boundaries, downstream flowpath, and potential/existing problems.

### Task 2 – Review all available information on the study area

This should include all available basin plans, ground water management area plans, drainage studies, floodplain/floodway FEMA maps, wetlands inventory maps, Critical Areas maps, stream habitat reports, salmon distribution reports, etc.

### Task 3 – Field inspect the study area

The design engineer should physically inspect the existing on- and off-site drainage systems of the study area for each discharge location for existing or potential problems and drainage features. An initial inspection and investigation should include:

- Investigate problems reported or observed during the resource review
- Locate existing/potential constrictions or capacity deficiencies in the drainage system

- Identify existing/potential flooding problems
- Identify existing/potential overtopping, scouring, bank sloughing, or sedimentation
- Identify significant destruction of aquatic habitat (e.g., siltation, stream incision)
- Collect qualitative data on features such as land use, impervious surface, topography, soils, presence of streams, wetlands
- Collect information on pipe sizes, channel characteristics, drainage structures
- Verify tributary drainage areas identified in task 1
- Contact the local government office with drainage review authority, neighboring property owners, and residents about drainage problems
- Note date and weather at time of inspection

#### Task 4 – Describe the drainage system, and its existing and predicted problems

For each drainage system component (e.g., pipe, culvert, bridges, outfalls, ponds, vaults) the following should be covered in the analysis: location, physical description, problems, and field observations.

All existing or potential problems (e.g., ponding water, erosion) identified in tasks 2 and 3 above should be described. The descriptions should be used to determine whether adequate mitigation can be identified, or whether more detailed quantitative analysis is necessary. The following information should be provided for each existing or potential problem:

- Magnitude of or damage caused by the problem
- General frequency and duration
- Return frequency of storm or flow when the problem occurs (may require quantitative analysis)
- Water elevation when the problem occurs
- Names and concerns of parties involved
- Current mitigation of the problem
- Possible cause of the problem
- Whether the project is likely to aggravate the problem or create a new one.

Upon review of this analysis, the local government may require mitigation measures deemed adequate for the problems, or a quantitative analysis, depending upon the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed design of the onsite drainage facilities. The analysis should repeat tasks 3 and 4 above, using quantitative field data including profiles and cross-sections.

The quantitative analysis should provide information on the severity and frequency of an existing problem or the likelihood of creating a new problem. It should evaluate proposed mitigation intended to avoid aggravation of the existing problem and to avoid creation of a new problem.

## 2.7 Adjustments

**Adjustments to the Minimum Requirements may be granted prior to permit approval and construction. The drainage manual administrator of the local government may grant an adjustment provided that a written finding of fact is prepared, that addresses the following:**

- **The adjustment provides substantially equivalent environmental protection.**
- **The objectives of safety, function, environmental protection and facility maintenance, based upon sound engineering, are met.**

## 2.8 Exceptions/Variations

**Exceptions to the Minimum Requirements may be granted prior to permit approval and construction. The drainage manual administrator of the local government may grant an exception following legal public notice of an application for an exception, legal public notice of the administrator's decision on the application, and a written finding of fact that documents the following:**

- **There are special physical circumstances or conditions affecting the property such that the strict application of these provisions would deprive the applicant of all reasonable use of the parcel of land in question, and every effort to find creative ways to meet the intent of the Minimum Requirements has been made; and**
- **That the granting of the exception will not be detrimental to the public health and welfare, nor injurious to other properties in the vicinity and/or downstream, and to the quality of waters of the state; and**

- **The exception is the least possible exception that could be granted to comply with the intent of the Minimum Requirements.**

#### Supplemental Guidelines

The adjustment and exception provisions are an important element of the plan review and enforcement programs. They are intended to maintain a necessary flexible working relationship between local officials and applicants. Plan Approval Authorities should consider these requests judiciously, keeping in mind both the need of the applicant to maximize cost-effectiveness and the need to protect off-site properties and resources from damage.